AMERICAN JOURNAL OF OPTOMETRY

VOL. 7 NO. 2

THE MINUS CYLINDER AND JAVAL RULE IN OPHTHALMOMETRY*

E. LeRoy Ryer, Opt. D., and E. E. Hotaling, Opt. D.
New York City

An attempt is under way to depose the minus cylinder from the high place it occupies in objective and subjective optometric technic.

On the whole, we think the movement unfortunate and shall resist it, not, we hope, as reactionaries but because of the firm conviction that there is far more to be lost than gained by such a change. Wishing to avoid arousing personal animosities and anxious only to bring out the truth, our efforts will be confined to broadening the scope of the discussion, to looking at it as it applies to the whole field of optometric practice rather than to some isolated section and, of course, to offering the evidence upon which is based our belief in the superior claims of the minus cylinder.

Whether employed in the fogging systems, still used by no inconsiderable body of practitioners in optometry, although not by the authors; in subjective testing of any order; in static retinoscopy; in dynamic retinoscopy; or in ophthalmometry we believe the minus cylinder, if properly applied, has marked advantages over the plus.

Not losing sight of its broad application we are particularly interested in the minus cylinder in its relation to the Javal rule in ophthalmometry because of its basic relation from this point on to all other methods used in routine procedure.

And, let it be definitely noted, we are speaking of the minus cylinder as a piece of *testing* apparatus and not as the cylindrical element of the final prescription. Let us assume that all our prescriptions are finally dispensed in the form of modern lenses and agree that to bring this phase of the subject into the discussion can result only in beclouding the issue to no useful purpose.

Let us state our position clearly to be as follows:

We rely on no single test as sufficient in itself to constitute an adequate analysis of an optometric condition.

---

*Submitted for publication December 15th, 1929.

As we must, therefore, use at least two and as most of us feel we must use four or more tests in every examination we avoid confusion and error by keeping uniform as many factors as possible throughout these tests. Specifically, we see danger of confusion and error in using minus cylinders in one test and plus in another, requiring changes in signs, in spherical components, and in axes, all of which are avoided by adhering to one form of cylinder throughout.

Were we not faced with the most serious necessity of controling physiologic accommodation in nearly every case analyzed we might admit it makes little difference whether we select the minus or the plus cylinder as our test lens, so long as we select *one* and use it consistently throughout all tests.

But, as optometrists, we *are* faced with the necessity of controlling accommodation and we have found after repeated unbiased trials that minus cylinders are superior to plus in both objective and subjective tests, in theory and in practice.

Look, briefly, at the tests above enumerated:

The fogging tests predicate the use of the minus cylinder solely and preclude any argument, so that is that.

If, in applying static and dynamic retinoscopy, we first correct the highest hyperopic meridian in simple and compound astigmia, the lowest myopic meridian in compound myopic astigmia, the hyperopic meridian in mixed astigmia we again predicate the use of the minus cylinder in each instance, as well as in simple myopic astigmia, and by so doing hold the accommodation under control, whereas, if we reverse this procedure so as to leave a plus cylinder called for, we excite and allow to run wild just that amount of accommodation.

The same holds true, and is a greater hidden menace, in all subjective tests where any accommodation can possibly come into play.

This leaves ophthalmometry. We here urge the use of the minus cylinder from a different basis. No accommodation is involved in the ophthalmometric test itself but as it is usually the first step in a routine examination the cylinder indicated by it is immediately applied in the tests which follow and if these tests require the minus cylinder there can be no justification for calculating the ophthalmometric readings in any but minus cylindrical form.

Now we come to the Javal rule for estimating the total astigmia from the ophthalmometric or corneal astigmic findings. This rule, we contend, predicates a minus cylinder which in turn justifies our efforts toward keeping intact the principle of uniform factors throughout the entire examination.

Those rare cases of keratoconus wherein contact glasses are called for may be ruled out of consideration at once as having nothing to do with the present issue. In every other case the lens used for testing the patient must be used at a considerable distance from the cornea, depending upon the length of the lashes, while the ophthalmometer readings from which this testing lens is cal-

culated are made in the plane of the anterior surface of the cornea. If therefore, the testing lens could be placed in contact with the cornal surface it would make essentially no difference whether it were a minus or a plus cylinder at its respective axis yet even here it would be wise to select and adhere to *one* form in order to avoid the confusion and error as to axes and signs.

But actually the testing lens must be placed some 15 millimeters from the anterior corneal surface hence mathematically and unquestionably this forward movement calls for a modification of the ophthalmometric reading if the testing lens set thus away from the cornea is to have the equivalent power of the ophthalmometric reading taken at the cornea and, again mathematically and unquestionably, that testing lens to have an equivalent value must be a minus cylinder of higher power or a plus cylinder of lower power than the figure shown by the ophthalmometer.

As is generally known, the constant **p** of the Javal formula calls for an *increase* in the testing lens of 25 per cent and must, therefore, signify the use of a minus cylinder and if plus cylinders are advocated and used they are sure to be too high in power if calculated by the Javal rule. In other words, a plus lens moved away from the cornea already becomes greater in effective power by that movement forward and in consequence should be reduced rather than multiplied by 1.25 as called for by the Javal rule for minus cylinders.

To claim, as the advocates of the plus cylinder do claim, that the Javal rule applies to such cylinders is to overlook the above very significant fact. The day may come when the plus cylinder will supercede the minus but if it come the plus cylinder should be employed uniformly throughout the entire examination and a new rule devised for coordinating it with the ophthalmometric readings.

Let us view it from another angle. If we are told that a —4.50 D. Cyl. 180 in the form of a test lens 15 millimeters from the cornea represents the total astigmia we have no choice but to assume that the ophthalmometric readings show less than 4.50 D. or approximately 4 D. difference at the cornea.

But tell us that a +4.50 D. Cyl. 90 test lens 15 millimeters from the cornea represents the total astigmia and we see no choice but to assume that the ophthalmometric readings show more than 4.50 D. or approximately 5 D. difference at the cornea.

And still from another angle. A given corneal ophthalmometric reading demands a higher minus or a lower plus testing cylinder set 15 millimeters away whereas the same power minus and plus cylinder demand a different corneal reading, lower respectively for the minus cylinder and higher for the plus.

Hence the Javal rule as it stands cannot be expected to work for both minus and plus testing values nor, to our minds, can any single formula.

So, while we know only too well that most rules seem to be devised chiefly for the purpose of affording cynics the keen satis-

faction of pointing out gleefully the frequency with which they do **not** hold we have found that though the Javal rule had to run the gauntlet like all others it came through rather better than most. We reiterate our belief that it applies to and was intended to apply solely to the minus cylinder and that its great value will be undermined if the efforts to substitute the plus cylinder succeed.

Having served us so long and so well in everyday practice we feel we owe it much and, as far as we have a right to speak for Optometry, we say it owes it much and that the least we can do is to sound a warning against changing over from minus to plus cylinders in any or all tests without most careful consideration and cautious reasoning.

Now that we have submitted some if not all of our own reasons let us look at further evidence from other sources.

Helmholtz,[1] who invented the ophthalmometer, but in a form that made measurements very time-consuming, never obtained sufficient data from which to deduce a rule such as Javal later attempted after extensive experience with the practical clinical model known as the Javal-Schiotz ophthalmometer, the parent of our present day Universal.

Javal[2] endeavored to express the relation between the total or subjective astigmia (As-t) and the corneal or ophthalmometric astigmia (As-c) by the empirical formula:

$$\text{As-t} = \mathbf{k} + \mathbf{p}.\ \text{As-c}$$

in which formula **k** and **p** are two constants, $\mathbf{k} = 0.50$ D. against the rule and $\mathbf{p} = 1.25$.

This formula gives the following as the relations which will exist between the ophthalmometric corneal measurements (Javal's As-c) and the lens power found subjectively which will correct the total astigmia (Javal's As-t):

	Against the rule			With the rule				
As-c	2. — 1.	— 0.	1.	2.	3.	4.	5.	6. D.
As-t	3. — 1.75	— 0.50	0.75 — 2.	— 3.25	— 4.50	— 5.75	— 7. D.	

We believe minus cylindrical values were intended to be associated with this rule and that the constant **p** being given the value 1.25 offers ample evidence in substantiation of that belief.

Sheard,[3] speaking of factors which may account for the differences between the corneal astigmia found ophthalmometrically and the total astigmia found subjectively, mentions five but only two of which (a) and (c) are pertinent to the present paper and are as follows:

"(a) *Deformity of the internal surfaces.* The vertical meridian of the posterior surface of the cornea presents a more pronounced curvature than the horizontal meridian, whether the condition in toto is one of astigmia with or against the rule. It is doubtless for this reason that eyes which have no ophthalmometric astigmia generally have subjective astigmia against the rule. The term **k** of Javal's formula must be influenced in part by the posterior surface

of the cornea.

"(c) *The influence of the distance of the correcting lens from the eye.* In consequence of this the concave cylinder is stronger and the convex cylinder weaker than the true astigmia."

Nearly every user of the ophthalmometer, whether or not he ever heard of the Javal rule, agrees upon deducting 0.50 D. from the ophthalmometric reading when it indicates astigmia with the rule and upon adding 0.50 D. when the reading indicates astigmia against the rule. Whether this allowance is called for because of deformities of the internal surfaces, obliquity of the crystalline lens, or astigmia in the different zones of the cornea we do not know and most of us did not care, having found, however empirically, that it worked. To the non-mathematical mind the above way of expressing that part of the rule seems more satisfactory but we have seen no end of trouble result from the questions that must arise as to whether the 0.50 is to be considered minus or plus and whether the axis is to be considered 90 or 180 and so on in circles of aimless confusion whereas to employ the constant **k** of Javal's formula means simply that we add algebraically —0.50 Cyl. 90 to any value found ophthalmometrically regardless of what that value may be. Thus if the ophthalmometer shows a —0.50 Cyl. 90 needed to equalize the two principal meridians we add —0.50 Cyl. 90 to this as the first step in applying the rule and obtain —1.00 Cyl. 90; if, however, the ophthalmometer shows a —0.50 Cyl. 180 we also add —0.50 Cyl. 90 and find our astigmia eliminated and no correcting cylinder called for; or if the ophthalmometer shows no difference in the meridians and therefore no ophthalmometric cylinder called for we still add —0.50 Cyl. 90 and know that —0.50 Cyl. 90 is the correcting cylinder so far as this part of the rule is concerned.

Of course we expect that some will argue that whether we use a —0.50 Cyl. 90 or a +0.50 Cyl. 180 for this part of the rule makes no difference. In one sense that is true but such an argument leaves out the fact which has been proved over and over that with both minus and plus quantities considered confusion worse confounded all too frequently results. And inasmuch as the constant **p** of the formula is to be associated with minus cylindrical values solely we advise avoiding confusion by adhering to minus quantities at every step and justifies our contention that Javal's constant **k** be accepted as —0.50 Cyl. 90.

So much, for the moment, for constant **k**. Now let us look at constant **p**.

Sheard[3] has something very significant to say about this, as follows:

"*Relations between corneal and total astigmia.* Quite a difference is often found between the ophthalmometric and subjective measurements. This was first pointed out by Donders and Knapp who attributed this difference to an astigmia of the crystalline which would act in a contrary direction to that of the cornea, Javal,

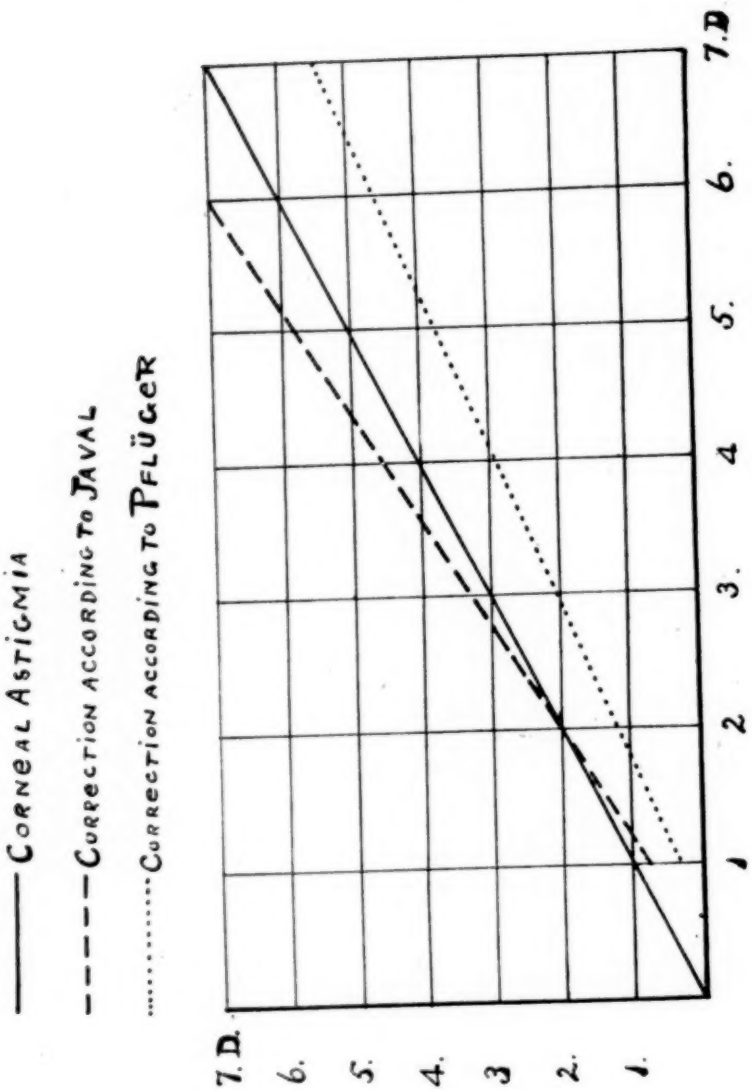


FIG 74 (AFTER SHEARD)

Pfluger, Tscherning and others have investigated the relations between corneal and total subjective astigmia. The curves in Fig. 74 are due to Javal and Pfluger; the ordinates represent the amount of astigmia in diopters. *Javal employed concave and Pfluger convex cylinders exclusively.* Hence the differences in their cylindrical lens corrections for various ophthalmometric determinations are due in part to the effectivity of plus and minus lens corrections situated at a certain distance from the eye. Quite apart from physiological reasons, then, apparent changes in the astigmia of the eye as a whole may arise from optical sources. There is a change due to effectivity as the cylinder is placed in advance of the cornea and as it is convex or concave. This causes the subjective determination of astigmia to differ from the ophthalmometric so that, for example, 4 diopters of corneal astigmia is corrected by a —4.25 D. Cyl. or a +3.75 D. Cyl. when placed 15 to 17 millimeters from the cornea."

Is it not evident, as we study Sheard's Fig. 74, that we are warranted in assuming the Javal rule was formulated for minus cylinders only?

From 2 D. upward his figures for the total astigmia keep rising higher and higher above the ophthalmometric astigmia and we are unable to deduce any cause for this other than the lessened effectivity of a concave lens as it is moved away from the cornea. Conversely, Pfluger's figures go downward from the start, as should plus cylindrical quantities which must be moved away from the cornea, and furthermore the plus values of Pfluger never could be arrived at from the ophthalmometric readings by the Javal rule.

No doubt a rule could be devised as useful for plus cylinders as is Javal's rule for minus cylinders but of necessity it would be equally empirical and serve only to throw the whole matter of testing from ophthalmometric readings back into chaos.

Inasmuch as today it is probable all corrections as finally ground into the lenses to be worn will be based upon vertex refraction principles we see no gain in misapplying Javal's rule to plus cylinders when the introduction of plus cylinders into optometric testing methods presents the possibility of confusion always and error frequently at every step in an examination. But before we treat these collateral phases of the subject let us see what further evidence we can deduce that Javal devised his rule in terms of the minus cylinder.

Tscherning,[4] who took over Javal's work when he became unable to continue as director of the laboratory of ophthalmology at the Sorbonne, may be deemed well qualified to comment on Javal's rule in ophthalmometry which he does at length and in the course of which comments he offers as his fourth reason, out of five, for the variations in relations between the ophthalmometric corneal astigmia and the total subjective astigmia the following:

"We must not forget the *influence of the distance of the correcting glass from the eye,* in consequence of which the concave correcting glass is stronger, the convex glass weaker than the true astigmia.

This influence makes itself felt the more according as the glass is stronger, and, in order to calculate it, we must take into account not only the cylindrical glass, but also the spherical glass with which it is combined (Ostwalt). If some authors have found that the subjective astigmia with the rule frequently exceeds that found with the ophthalmometer (the factor **p** of Javal) it is due, perhaps, to the fact that they generally use concave cylinders."

Javal was one of those certain authors referred to above by Tscherning who found in all cases of astigmia against the rule as well as in all cases of astigmia with the rule above 2 D. the subjective findings exceeding those of the ophthalmometric corneal readings and here is still further corroboration of the belief that Javal worked with minus cylinders and based his rule upon their use. Tscherning's parenthetical allusion in the above quoted paragraph to the factor **p** of the Javal formula must be very significant to any open-minded investigator.

Still more evidence in support of Javal's association with minus cylinders is offered by Adolphe Javal, Jr.,[5] who works out a slightly different formula but shows by his coefficient 1.25 that he has been guided by the minus cylinder usage because as this coefficient includes, according to his own words, the change in the effective value of the cylindrical glass due to its distance from the cornea we must assume that a minus cylinder is used because only a minus lens would have to be multiplied by something over unity, i.e., 1.25, to bring back the effectivity lost in being moved away from the cornea where the ophthalmometric measurements are taken but where a lens of that exact power cannot be worn in contact with the corneal surface. But let A. Javal, Jr., speak for himself which he does as follows:

"It is not impossible that when ophthalmometry shall have made sufficient progress, we may be able to construct a curve, or establish an empirical formula, by means of which the probable total astigmia may be calculated from measurements of the corneal curvature as made with the ophthalmometer.

"For the present we may adopt, as fairly in accord with the data derived from observation, a formula, of the first degree, of the form

$$y = a + bx.$$

"In this formula **y** represents the total astigmia and **x** the corneal astigmia; it remains to find values for the two constants **a** and **b.**

"The independent term **a** is probably determined in great part by astigmia of the posterior surface of the cornea. According to Bull and Chibret, the value of this term is about three-fourths of a diopter in the inverse sense, i.e., —0.75 D. (axis 90). In fact, when we measure an eye in which no subjective astigmia can be detected, the statistics of Nordenson and of Schiotz show that there is generally present from 0.50 diopter to 0.75 diopter of corneal astigmia "according to the rule," and also that when the anterior surface of the cornea shows no astigmia there is generally found an inverse

subjective astigmia of about 0.75 diopter. Numerous observations, made by different investigators, show that this astigmia, which, to avoid prejudging the case, we shall call internal, and which is on the average equal to —0.75 diopter, may be greater or less than this mean by about one diopter. It appears, then, that the normally constructed eye shows a slight direct astigmia of the anterior surface, and that this direct corneal astigmia is approximately neutralized by an inverse internal astigmia of the same grade. The factor **b**, whose value also has been determined empirically, depends, probably, upon a deformation of the crystalline lens, giving rise to an astigmia proportional to that of the cornea—to a sympathetic astigmia we might almost say. In this coefficient which has been found to be equal to about 1.25, is included also the change in the effective value of the cylindric glass due to its distance from the eye when the eye is examined subjectively."

The last sentence of the above quotation affords still more evidence that minus cylinders were used in testing the total astigmia subjectively.

For this formula A. Javal, Jr., definitely states that the value of **a** is to be accepted as —0.75 diopter in the inverse sense and as this varies —0.25 diopter with the **k** (—0.50 D. Cyl. 90) of Javal's original formula it changes all findings a 0.25 diopter which is, of course, of no serious moment. It has a bearing on the point under consideration because it shows the general tendency to deal in minus cylindrical quantities in dealing with ophthalmometric calculations.

Skeffington,[6] pointing out that the ophthalmometric findings are indispensable in any diagnosis of visual conditions, says this about the rule for turning those findings into corrective test lens values:

"With the dioptral value of left and right eye known, then the commonly accepted formula (Javal) for the determination of the effective cylindrical power is used. The formula is given as follows: The total difference in curvature plus one-fourth of the total difference in curvature, plus minus fifty axis ninety, gives the effective lens power about 15 millimeters from the eye.

"The reason for this formula is obvious. Since we are dealing with minus as the determinations are made on the cornea proper, and as the lens will be placed some little distance from the eye, consideration must be given to this fact. Minus lenses moved farther from the eye must have their power increased to maintain the same effective power as though they remained in contact with the cornea. This alteration in distance is the reason for the addition of one-fourth of the total difference in curvature."

So here we see again, and this time by one of our most practical and widely traveled clinicians, the same tendency, or habit, if you will, of using minus cylinders in testing. We wish to lay a little extra stress upon this because we believe that Skeffington represents the average optometric practitioner in every section of this

country and finds them using the minus cylinder in their tests and sees no reason for disturbing that uniform practice.

Crossing to England we find Sutcliffe, the designer of the one-position Sutcliffe keratometer thinking with us in terms of minus cylinders and specifically recommending them as he advocates the following rules for use with his instrument:

"For astigmia with the rule, using concave cylindricals, add one-half of the ophthalmometric reading to itself and deduct 1.00 D.

"For astigmia against the rule, using concave cylindricals, add 0.50 D. to the ophthalmometric readings."

Many of our readers will recall the works of Lockwood, from three of which let us quote very briefly a few passages which give unmistakable evidence that he had in mind constantly the need for controlling the accommodation and the advantage of the minus cylinder methods for doing it:

"In the skiascopic test[7] it makes no difference so far as the test itself is concerned what kind of astigmia may be present, myopic, mixed or hyperopic. When we have placed the correct spheres in the trial frame we have always brought the eye to a condition of myopic astigmia, when the dioptric condition of the eye with the accommodation relaxed may be calculated for distance."

Again,[8] speaking of the fogging method and showing the technic of reducing the fogging lens so as to hold the accommodation in check most effectively, he adds, "Repeat the process until one set of parallel lines on the clock dial chart is black and clear and the others not, when minus cylinders should be applied with axes at right angles to the best visible set of lines, until all the lines on the chart are equally clear."

And again,[9] "Now, increase the power of the lenses, if plus, or decrease the power, if minus, until all the lines on the chart are blurred. Then take the clock dial from the wall and holding it with the VI to XII lines exactly vertical, steadily approach the patient. Direct him to tell you which series of lines come out clear the first. This will always show the meridian of greatest power, and by noting the point where they become clear, while the lines in the opposite direction are still blurred, an idea may be gained of the refractive condition of the eye so far as that meridian of the eye is concerned. This is discovered by converting the distance from the eye at which the first lines come clear into diopters, and subtracting the same from the power of the lens which happens to be in the frame.

Place the clock dial back on the wall, and decrease the power of the lens in the frame just enough if a plus, or increase it if a minus, until the patient again sees the lines of the most defective meridian clearly while all the others are more or less blurred. Now apply minus cylinders with axes at right angles to the blackest lines, which is always the most defective meridian, until all the sets of radiating lines are alike."

And so we find throughout the literature, from which we could

quote interminably, that those who treat of optometric methods use first the highest plus and lowest minus spheres to control the accommodation or to avoid exciting it needlessly and secondly always employ minus cylinders to reduce the astigmia; while those who believe in cycloplegia use minus cylinders in myopic conditions and plus in hyperopic. Many seem to think it of no moment whether plus or minus cylinders are used in any case but this seems the result of lack of attention rather than of any well thought out idea.

Ryer,[10] who has made through many years earnest efforts to place the practical usefulness of the ophthalmometer within the reach of everyone, found the greatest stumbling block to be the confusion that resulted from the employment of both plus and minus cylinders with the resulting necessity of coordinating different signs and different axes in ophthalmometry itself as well as throughout the various subsequent tests. He therefore urged the acceptance of *one* form of cylinder and advised the minus, first because the minus cylinder was so universally employed in the other tests and, secondly, because it worked so well in connection with the Javal rule in some 48,000 measurements he recorded. He seems to sum up the situation fairly and sensibly as follows:

"Hence, if the correction could be made at the cornea, it would make no essential difference which form of cylindrical were used; but the correcting lens cannot be placed at the cornea and some allowance must be made for the distance the lens must be moved forward. To move the plus cylindrical away from the cornea increases its effect and requires that a plus cylindrical, if used, be reduced in power; while moving the minus cylindrical away from the cornea decreases its effect and requires that a minus cylindrical, when used, be increased in power over that which is shown by the ophthalmometer to be called for at the corneal surface.

"A weak point theoretically, but a very strong one practically, lies in the fact that most examiners do not consider this change in effective power at all; hence if the minus cylindrical be employed the error, if any, will be one of under correction and under correction of astigmia is much to be preferred to over correction; and on that basis the employment of the minus cylindrical is advocated in ophthalmometry.

"Again, the cornea is always a convex quantity and in astigmia we find two convex dioptric quantities; and it seems natural to neutralize this excessive plus power of the meridian of highest power with a minus cylindrical quantity but, as shown above, it really makes no difference whether the high meridian is brought down to the low with a minus, or the low raised to the high with a plus, cylindrical. This point is worth no more than passing notice.

"The author urges the employment of the minus cylindrical quantity in all ophthalmometric calculations, not only because it seems more natural to neutralize plus corneal conditions with minus quan-

tities or because minus values will tend to guard even the careless examiner against over correction, but mainly because the minus cylindrical is far superior and almost, if not quite, universally used in retinoscopy and subjective testing, and lends itself to simple comparison and calculation without transposition throughout the entire examination. If one uses the minus cylindrical in subjective testing and retinoscopy, he merely adds unnecessary and unjustifiable confusion if he introduces plus cylindrical ophthalmometric values into the problem. For example, we will assume that we find by the various tests the following:

Retinoscope static +2.00 D. sph. = —1.25 D. cyl. ax. 165.

Retinoscope dynamic +2.50 D. sph. = —1.37 D. cyl. ax. 160.

Subjective distance +1.75 D. sph. = —1.25 D. cyl. ax. 165.

how natural to add:

Ophthalmometer 48 D. meridian 160)
) = —1.50 D. cyl. ax. 160;
Ophthalmometer 49.5 D. meridian 70)

and how unnatural to add:

Ophthalmometer 48 D. meridian 160)
) = +1.50 D. cyl. ax. 70;
Ophthalmometer 49.5 D. meridian 70)

which though equally correct, introduces a jarring and distracting element unnecessarily in the opposite sign and reversed axis.

"If the minus cylindrical be used throughout, the slight discrepancies are easily compared and their true significance comprehended, even the slight difference in axes between the results of the tests made with the visual lines parallel and those with the visual lines converging causing no confusion and simply pointing out the possibility of slight torsion under convergence, whereas to bring in the plus cylindrical ophthalmometric value requires intense thought to even properly interpret the significance of the seemingly odd axis.

"In the trial case, one has a choice between plus and minus cylindricals, although we know that few use the plus, but in the various phoro-optometers that are replacing the trial cases, minus cylindricals only are embodied as standard, and in this case the minus cylindrical values are forced into both the retinoscopic and subjective phoro-optometric findings and lend added weight to the advocacy of the use of the minus cylindrical in ophthalmometric readings.

"Incidentally, it should be noted that the astigmic cornea is always a convex toroidal surface and the plus cylindrical element which creates the astigmia is logically corrected or neutralized with a minus cylindrical lens."

Because of our sincere and apparently well grounded conviction that ophthalmometry has a unique claim upon all conscientious practitioners in optometry we have done everything within our power to advance that claim. Elsewhere,[10] some years ago, we stated that experience and comparative observations over a long period have proved that the ophthalmometer has no substitute. Its findings are

unique. Whether the prescription for corrective lenses is to be based upon subjective findings alone or upon the combined retinoscopic and subjective findings, the case is treated unjustly if any or all of the findings are not submitted to the corroborative test available in ophthalmometry.

The years rolled by, our experience ripened and today that faith has evolved into certitude that it is unwise and unfair to omit ophthalmometry from any routine optometric examination.

In the class room, on the lecture platform, in book and in magazine, in conversation and in correspondence we experienced a continual outcropping of one pestiferous obstacle to a general, wholehearted acceptance of ophthalmometry. The principal meridians could be located, the relative values of those meridians could be measured but whether the correcting test cylinder should be plus or minus and set at axis 90 or 180, at 45 or 135, at 60 or 150 presented a phase of trouble that effectively checked any further effort on the part of many serious workers.

Without having had similar experience as an instructor in ophthalmometry one cannot comprehend the insidious power of this deterrent influence. We fought that influence for years but not with success until we eliminated the confusion by devising the simple, single rule which follows:

To interpret any ophthalmometric reading, consider the sign always to be minus, the power to be the difference between the principal meridians and the axis to be that associated with the lower meridian.

This minus cylindrical finding, modified by the Javal rule, then becomes the basis of testing for astigmia throughout the entire examination by both objective and subjective tests.

On such a basis confusion was eliminated not only in ophthalmometry but in every other test and in a general comparison of all the tests used in the analysis.

It is thus readily perceived why we are partial to the minus cylinder and as readily perceived, and readily granted, that we are unduly prejudiced against the plus cylinder and too predisposed in favor of the minus.

But weighing all the evidence we can deduce from others and from our own experience we conclude by urging:

First, that the Javal rule was designed for and fits with peculiar felicity the minus cylinder.

Second, that the minus cylindrical value thus obtained forms the most practical basis for all subsequent objective and subjective tests.

Third, that confusion is avoided especially in ophthalmometry and to no inconsiderable degree throughout all subsequent tests by adhering strictly to the minus cylinder.

Fourth, that if those who now advocate the substitution of the plus cylinder for the minus continue to do so, they should in fairness supply a substitute for the Javal rule.

Fifth, that if they succeed in replacing the minus cylinder by the plus in ophthalmometry they accept the resultant responsibility of replacing it likewise throughout all other tests.

Sixth, that in discussing this problem, of such import to optometry, they do not confuse the issue by injecting any discussion in relation to the form of lens to be worn finally in the finished product but confine the discussion within its proper limits of considering the relative merits of the plus and minus cylinders as testing agents.

Seventh, that with all our earnest advocacy of the Javal rule being applied solely to minus cylinders we be credited with the willingness to recognize the possibility of just claims being advanced for the plus cylinder and the problem considered to be the need for a full, unbiased reconsideration and reconstruction of the entire optometric technic provided the revision, if made, will comprehend the whole field and not limit itself to tampering with a part only which is bound to result in throwing our entire technic back into that chaotic state which existed so long as, and will exist again if, both forms of cylindrical values are permited to confound the required calculations.

Eighth, that we, therefore, consider the issue to be a bold, complete acceptance of either (1) the Javal rule and the minus cylinder with the minus cylinder used throughout all tests or (2) a new ophthalmometric rule for the plus cylinder with the plus cylinder used throughout all tests.

DRS. E. LeROY RYER and E. E. HOTALING,
NINE EAST FORTY-SIXTH STREET,
NEW YORK CITY.

BIBLIOGRAPHY

[1]Helmholtz, H.—Handbuch der Physiologischen Optik, 1909. Southall Translation. 1924.
[2]Javal, E.—Memoires d'Ophtalmometrie. 1891.
[3]Sheard, C.—Physiological Optics. 1918.
[4]Tscherning, M.—Physiologic Optics. 1900.
[5]Javal, A., Jr.—Ophthalmometry and Its Clinical Value. Oliver and Norris System of Diseases of the Eye. 1897.
[6]Skeffington, A. M.—Procedure in Ocular Examination. 1928.
[7]Lockwood, R. M.—Skiascopy Without the Use of Drugs. 1906.
[8]Lockwood, R. M.—Subjective Tests for Difficult Cases. 1904.
[9]Lockwood, R. M.—The Trial Case and How to Use It. 1904.
[10]Ryer, E. LeRoy—Ophthalmometry. A Practical Text Book. 1925.

CHROMAGRAPHOLOGY

W. Jerome Heather, Opt. D.
Philadelphia, Pa.

CHAPTER ONE

Introduction

This, the first of a series of twelve (12) chapters, will not only be used as the medium to express the aims, desires, and purpose of the writer, but will incorporate the derivation of the title as well as the arrangement of the chapters which are to follow, so that the reader may clearly see the plan of this work.

Inasmuch as the title, i.e., *Chromagraphology*—which, so far as known, is used for the first time by the writer—compels definition; a statement of its meaning, and reason for its construction is desirable. It will be necessary for purposes of simplification, that it be considered in the light of the three parts, which enter into its construction.

—Chroma (after Ladd-Franklin), the sadly ambiguous word, *colour* should be used in its inclusive sense, as including the whites, blacks and the black-whites (or greys). The colour sensations should then be divided into the achromatic and the chromatic ones—of the former, white is a *light* sensation; black is a *non-light* sensation. The chromatic sensations are in the order of their development; the "unitary" yellow and blue, then red and green. In addition to the unitary chromata, we experience four (not six) dual chroma-blends —the blue-green, the green-yellows, the blue-reds ("purples") and the red-yellows ("oranges"). The remaining two dyads of chroma, red and green, yellow and blue, are "vanishing" chromo-pairs—they unite to form respectively yellow and white. Besides the word "chroma" (plural chromata), we shall also need (for white and black) achroma (plural achromata). It will then be easy to substitute the perfectly good and significant words achromaticity and chromaticity for the poor "degree of non-saturation" and "degree of saturation."

—Graph is defined as a record of, or a recording of, in this series, a chart.

—Ology, when used as a suffix, denotes a science or study.

Chromagraphology, then, Optometrically and Opthalmologically considered, is the scientific study and recording of chromatic interpretations of the human eye.

Chromagraphology has been coined, and is offered for Optometric usage for two reasons: First, available books devoted to the subject of visual field studies have been concerned to a considerable degree with the visual response to the achromatic sensation of white light, and the findings obtained have suited the needs and answered in a "confirmatory fashion" (Traquair) the requirements for cranial

surgical interference, glaucomatous complications, etc., it being necessary, of course, that scotometry be included therein. Here and there in the writings, references have been made to colour interpretations, but in an indefinite fashion (such does not appear in any chapter heading of the works of Lloyd or Peters, and is mentioned only in Traquair's work in the appendix), for the reason that, no attempt has been made to consider colour sensations with reference to their basic principles, nor to refer to or classify them as visual colour field studies. In summing up the first reason then, there is certainly too much importance and diagnostic value to the sciences involved in colour field work, to suffer its burial in a terminology so nearly alike (hence confusing) as that of visual field studies. Second: Most of the recent outstanding advances and real practical application of colour field studies have been accomplished by the science of Optometry, in our colleges, on the lecture platform, and among individuals to whom credit will be given as this series continues. Therefore, for various sufficient reasons enumerated above, *Chromagraphology* is not only Optometric, but as will be developed in the chapters to follow, clears up and removes many hazy points that have proven stumbling blocks to the practical application of the principles in the past.

This series is being written with a desire to gather together the fragments of value from all known sources, to lift them from the obscurity of their position among visual field studies, and place them in a position designed to allow their association in a manner that will retain their scientific accuracy (where that is available), and at the same time make them fully practical. The writer with others believes that in colour field studies lies a diagnostic significance and possibility—the depths of which have not been appreciated nor fathomed until very recent times. This is probably best expressed in the recent removal of Dr. C. E. Ferree and Dr. Gertrude Rand from Bryn Mawr College where their work was confined to the careful study of lighting—to the Wilmer Ophthalmological Institute of the Johns Hopkins University, commissioned there to make intensive laboratory tests relative to the interpretation of colours and their diagnostic significance.

It is true that several individual practitioners have accomplished worthwhile results, and despite the fact that many others are vaguely aware of such work, a careful study of visual colour fields is not appreciated sufficiently among the professions. Many reasons can be offered as being responsible for this condition, the foremost of which is lack of understanding. Without any desire or attempt, as one lecturer described in a recent letter "to throw overboard all authorities to date," but with due respect to all concerned, the available material in print has most certainly been placed in an obscure position, and in an uncertain fashion, among the better understood visual field studies, that being the main objective of such work. Then too, the little space that is devoted to colour field studies in available literature is filled with contradictions and reversals.

The splendid work "An Introduction to Clinical Perimetry" of H. M. Traquair, M. D., F. R. C. S., Ed., was, of course, not written particularly for its value in colour field determinations, for it has little, but is the outstanding work on "visual field studies." "Principles and Practice of Perimetry," by Luther C. Peter, A. M., M. D., F. A. C. S., has approached the subject primarily from the standpoint of visual pathways. Both of these leaders have acceptably considered the peripheral fields of vision. "Visual Field Studies" by Ralph I. Lloyd, M. D., F. A. C. A., has rightly become the authority on central fields, but again, mainly from the standpoint of visual field affectations by conditions along the optic pathways.

It is true that reference is made in all of these volumes to colours, but with not sufficient certainty founded on basic facts and reasoning, to give the various practitioners a fundamental and definite working basis. Considerable has been accomplished in recent years by Drs. Ferree and Rand, in determining the variable factors which affect the sensitivity of the peripheral retina to colour, and therefore, the results of field taking. Their work has succeeded in exposing many of the pitfalls that should be avoided in work of laboratory accuracy which has been valuable, in that it has created deep considerations, but still the average practitioner has, in the main, gained little from such considerations.

The aforementioned outstanding practitioners who have made notable strides in colour field work, have most certainly offered a hopeful future to many others, and they are daily becoming more and more aware of their needs in this connection.

In explanation of the development of this subject matter, it must be remembered that although scientific and technical accuracy will be maintained throughout, it is designed to be easily read and understandable for it seems possible to relieve the subject of some intricacies that have prevented earlier and more rapid acceptance. To that end the following skeleton arrangement is presented, each part of which will be enlarged upon immediately, and later will form the burden of successive chapters.

Chapter I—Introduction.
Chapter II—Historical Survey.
Chapter III—Vision.
Chapter IV—Colour—The Theory.
Chapter V—Chroma Interpretations—Normal and Abnormal.
Chapter VI—Theoretical Cause and Diagnostic Value of Alteration.
Chapter VII—Focal Infections.
Chapter VIII—Systemic Toxemias.
Chapter IX—Organic Involvements.
Chapter X—Valuable Aesthesiometric Determinations.
Chapter XI—Basic Principles.
Chapter XII—The Technique of Tangemetric Campography-Bibliography.

Historical Survey: In this chapter will be found the earliest considerations of the peripheral field of vision, followed through to our present rather complete understanding; facts about its makeup; its size; its usage; and its importance from a visual standpoint, as a protective agency, and also its diagnostic value.

The early difficulties of charting will be considered, associated with the development of necessary instrumentation. The fact that the instrumentation, accomplished through the tangent screen, the perimeter, and the campimeter was beset at every turn by difficulties and problems, some of which were solved only in part, until very recent years, will be very carefully analyzed.

The comparatively recent consideration of colour will include the rare works of Dr. George de Schweinitz, whose book, "Toxic Amblyopias," published in 1896 (now out of print), marked one of the earliest statement of findings, should be of value to all those interested in colour. Finally, the importance of colour field charting in routine procedure will be emphasized through an elaboration of the following four reasons—health indication, prognostic guidance, progress charting and professional collaboration.

Vision. Careful consideration and analysis of the material available, having reference to the evolution of the visual apparatus has made it possible to present material under this subject, which while combining the basic facts, will at the same time avoid such technicalities as might tend to depreciate its value from the standpoint of simplicity. Life as defined by Herbert Spencer is the continual adjustment of the internal and external worlds. The changes in the external world are accomplished through environment, requiring an adjustment of the individual, through his sense organs. In developing this thought, it will be shown the great degree to which the eye is responsible. Remembering that the eye to a greater degree than any other special sense organ is responsible for what the writer sees fit to term "the extension of the ecstasy of existence." Building on this necessary foundation, a discussion of the development and functions of the retinal elements will be established. It is promised that this will not be in the usual stereotyped form.

Colour—The Theory. Perhaps no one has ever presented the "Unsolved Riddle" of colours more clearly than J. E. Sturmer, Ph. M., Phar. D., Dean of Science in the Philadelphia College of Pharmacy and Science, in the American Journal of Pharmacy for May, 1925. He said, in part: "In the objective study of colours, we have a great accumulation of facts about wave lengths, reflection, refraction, diffraction, dispersion, interference, scattering, selective absorption; about pigments and dyes, their chemical makeup; about chromophore, and how to synthesize compounds which possess colour. Science has also gone beyond the demonstrable facts in the realm of speculation, and has tried to evolve a hypothesis, connecting the phenomenon of selective absorption with the electron theory. But here we might remember, that a hypothesis is after all only 'a theory on probation,' and that speculative thought in science means reasoning

from premises not yet proven. Colour is one of the great mysteries, and a mystery is something about which we know only enough to make us curious; and this indeed is what science is still compelled to say about colour." We know just enough to make us acutely curious. In this chapter will be presented the rich results of personal contact, with some of the best known theorists from each of the opposing camps; physics and psychology. In gathering this material, a correlation of personal interviews, intimate correspondence and actual laboratory experiments will be presented, as coming directly from such institutions as the general chemical laboratories of the U. S. Rubber Company, the Physics Department of the Northwestern University, the Ophthalmological Division of the University of Pennsylvania Hospital, the Wilmer Ophthalmological Institute, Johns Hopkins University, Baltimore, Maryland, the Psychologic Departments of Columbia University in New York City, and Bucknell University of Lewisburg, Pennsylvania. It is promised in this connection that some startling statements will be made, eliminating some of the confusing and perhaps unnecessary, but most surely retarding statements regarding saturated colours, and types of stimuli bearers that seem to perennially crop out. Each of the leading theories will be expounded and compared completely, but with brief simplicity.

Chroma Interpretation—Normal and Abnormal. Despite the fact that many different opinions have been expressed as to normal limits of colour interpretation, with regard to human visual equipment, and that they have been further rendered indistinct by experiments involving saturation, pre-exposure, considered mainly from the physical viewpoint, it will be shown that with instrumentation, which has been evolved from simple principles, and with more consideration given to the psychological aspect, much of the present confusion will be eliminated. Bear in mind, as will be proven, that in considering abnormal interpretations, atavism will be a factor but not of sufficient degree, to prevent further abnormalities having ophthalmologic significance, in the realm of symptomatology.

Theoretical Cause and Diagnostic Value of Alteration. There does not seem to be a compilation of possible causes underlying and accounting for the alterations, which are found clinically in Chromagraphologic work. Yet it seems that if we are to use such information diagnostically, we should, as reasoning individuals, want to know why changes take place, thereby strengthening our convictions. This cannot do other than build a substructure of confidence which will support a superstructure of scientific discrimination so valuable in the recognition of disease by its symptoms.

In this chapter, the reasoning of valuable Optometric and medical authorities, which reasoning after all is only theoretical, yet is indicative of a biological basis for our work, will be presented, again as the result of personal interviews.

Focal Infections. As is well known, there are many possibilities covered by this heading, careful consideration of which will tend to

remove the indecision of the past in our work with the delicate visual apparatus. From a practical standpoint, colour field studies might be interesting for laboratory data, but could not be helpful to the average practitioner unless resolved into terms of diagnostic meaning. Therefore, this chapter will be made interesting and instructive by specimen cases gathered from various sources, in addition to an explanation of the cause and effect involved.

Systemic Toxemias. At some time in the experience of every reader, either in connection with their own health or with that of referred patients, the questionable diagnosis of "toxic condition" has been advanced for bodily disturbances which could not otherwise be satisfactorily explained. The combined work of several authorities on refraction seems to indicate the possibility of a very logical solution to this all too common "condition." Briefly, this condition is one in which the blood is supposed to contain poisonous products, either produced by the body cells, or those due to the growth of micro-organisms, and as may well be supposed, might cover many questionable "guess and miss" determinations. One Optometric writer recently made the statement that "the refractionist of the future will become the analyzer of human ills when he learns to use the diagnostic measures that are within his scope of endeavor."

In expanding this subject, as will be done in Chapter VIII, many interesting developments often ignored will be presented relative to the division of the "toxic conditions" (which might better be called systemic toxemias) into those of a transient nature, appearing and disappearing with the usage and elimination of certain toxicants, usually of an exogenic nature; and those, of a more permanent type, associated with functional derangements seriously involving the success of the individual practitioner, and most certainly dangerous to the well being of such patients as present themselves. In short, a way of eliminating the troublesome and dangerous "grief case."

Organic Involvements. Failures along the tenth cranial nerve, better known as the pneumogastric or vagus nerve, that great sensor nerve which through filaments from motor sources, influences deglutition, the action of the heart, the circulatory and respiratory systems, voice, the secretions of the stomach, intestines and various glandular organs, and the contraction of the walls of the stomach and intestines has, of course, tremendous import. It will readily be seen through the development of this subject in Chapter IX that functional derangements when continued over a period of time may easily lead to such involvement. The importance of this to the refractionist, and to his patient must not be ignored, and may well be used to strengthen consultation or reference. Specimen charts and case reports will appear in this connection, and will increase the helpful practicality of the subject.

Valuable Aesthesiometric Determinations. Certain conditions affecting the human body advance in degree of intensity, others which

offer no indication except what might be derived from intercranial exploration (of course, entirely impossible), affect the second cranial nerve which has as its ending the eye. Signs are very evident, therefore, that a great deal of neurological significance may be found by using field charting as the aesthesiometer of the second cranial nerve. This naturally will include a scotometric interpretation as well as alterations in the shape, size and position of the blind spot of Mariotte.

Basic Principles. Throughout life, whether considered from a social, physical, physiological, scientific or technical angle, nothing seems to have much security which does not have a solid foundation on basic principles. This cannot do other than apply to our work in field charting, especially Chromagraphologic studies. It will be shown in this chapter, that if some of the energy being diverted at present, to a probably useless detailed discussion of minute points concerning colour, should be applied to such basic principles as the avoidance of motion, instantaneous colour changes, unannounced stimuli, unvarying illumination, light adaptation, objective fixation check, control of the distance factor, necessity of rapidity, low demands on the intelligence of patient and operator, and simplification of comparison and determination, much will be gained.

The Technique of Tangemetric Campography. For good and sufficient reasons, discussion of the charting of colour fields, or the measuring of chroma interpretations, by way of the Tangemetric Campigraph, will be confined to the final chapter of this treatise. This—because the instrument in question is a purely Optometric development which has taken place under the constant observance of the writer, who is prepared to and will support the statement that "it is the only instrumentation, to his knowledge, completely answering all the demands of *Chromagraphology.*"

A DIGEST OF THE TECHNICS OF DYNAMIC SKIAMETRY*

Arene T. Wray, Opt. D.
Los Angeles, Calif.

The past year has witnessed the bringing forth of several splendid papers on dynamic skiametry, which, I am sure, were heartily welcomed by the profession. Dynamic skiametry has been hailed by some as the *sine qua non* of optometric procedure; it has been scoffed at by another group as useless; has been a perplexing factor to many of us, and has been practiced in almost as many ways as there are practitioners. Dynamic skiametry has been bewildering to many, and with this in mind I will review some of the theories.

According to Dr. F. A. Woll, the late Dr. Andrew J. Cross brought forth dynamic skiametry approximately 39 years ago, but his book entitled "Dynamic Skiametry in Theory & Practice" was published in 1911—eighteen years ago. The basis for Cross' theory was his assumption that most eyes, no matter what the age of the patient may be, will only surrender the accommodative excess which has been required for near vision. This excess is composed of spasm of accommodation or latent hypermetropia. You will notice that he does not mention negative relative accommodation—a moot question. The "dynamic method * * * is made while the accommodation is exciting itself sufficiently to readily accept refractive assistance up to a point where its relation with another muscular force called 'convergence' is interfered with."**

Cross used a fixation stand which was movable and adjustable as to height. The target consisted of a card placed 40 inches with dots upon it which were to be counted by the patient, while the examiner, seated at 39 inches made the necessary lens changes, stopping with the shadow slightly "with." The patient was then requested to look at the fixation card on the skiascope, and if a reversal was had the correction obtained previously was about right. Then Cross made several further observations and neutralizations at closer distances crowding on the plus but never going to an against motion with too much plus. He recommends observations at 40″, 16″ and 13″, checking each finding with subjective procedure.

In measuring myopia Cross adds minus lenses until a "with" motion is effected, and I assume, records his findings as of the lens

*Paper read before the Los Angeles County Association of Optometrists, Sept. 19th, 1929.

**Cross-Dynamic Skiametry, p. 81.

previous.* Such procedure, I believe, is incorrect if the measurement of the hyperopia is taken as of the lens which just precedes reversal of motion, but this will be discussed more fully later on.

In the "Bulletin of Lectures" of the June, 1928, Annual Convention of the California State Association of Optometrists is an article on "Dynamic Skiametry"** by Dr. Charles Sheard. His definition of dynamic skiametry is "an objective method for the determination of such quantities of lenticular power as will make the retina of the active or dynamically functioning eye and the object fixated (which is placed ordinarily at a relatively close distance to the eye, such as the normal reading distance) conjugate points."

Dr. Sheard's article is not very lengthy and much of it is a repetition of former articles. His technic involves concentration on the part of the patient upon the target in order to insure full activity of accommodation and convergence. This of course, is in variance with Woll Atkinson's simple fixation method.

That accommodation and convergence are not bound together as rigidly as Cross maintained; i. e., 1D of accommodation to three prism diopters of convergence, is the consensus of opinion today, but this belief need not vitiate the practice of dynamic skiametry. Neither need the current divergence of opinion regarding the association between accommodation and convergence, the control of one over the other, impair the value of dynamic skiametry. Our findings simply tell us that when a given patient is using his eyes dynamically at a given distance there is indicated at that time a certain lens combination to render his fovea conjugate with the object studied.

Sheard again disagrees with Cross on the grounds that Cross' measurements include negative relative accommodation, which of course is very evident. Sheard also advocates a technic which involves an initial procedure of static skiametry. All spherical lenses obtained statically including that of the working distance are left before the eyes and then the dynamic skiametric measurement is made at 33 cm. His working distance for static is 75 cm., equivalent to 1.37D, of which he allows but 1D, since it is his belief that a noncycloplegic measurement slightly underestimates the hyperopic error or overestimates the myopic error. From .50 to .75D. is allowed for the lag of accommodation, which would result in a finding of neutrality upon sweeping the eyes with the retinoscopic light, indicating a correctness of the static findings, that the findings will be satisfactory for near and distance, and that the relationship between accommodation and convergence is normal. If there is more than plus .75D difference between the static and the dynamic findings (the first neutralizing lens) there is indicated one or more of the following circumstances:

1. Plus finding in static too low; minus finding in static too high.

---

*Cross-Dynamic Skiametry, p. 117.
**Published in The American Journal of Optometry, Nov., 1929. p. 609.

2. Spasm of accommodation.
3. Subnormal or inefficient accommodation.
4. Presbyopia.
5. Extrinsic muscular anomalies influencing the normal functioning of accommodation and convergence.

Sheard calls attention to the fact that Dr. Ernest Petry,* former dean of the Rochester School of Optometry, advocates the use of 1 meter distance for making dynamic skiametric measurements, since he finds it easier to interpret the motions of the reflex at that farther distance, because he believes convergence offers less resistance to accommodation at 1 meter than at 33 cm., because at 1 meter greater concentration is needed to discern the object viewed.

Tait's views on lag of accommodation and lenticular tonicity give a new slant to dynamic skiametric measurements.

"In youth the average lenticular tonicity amounts to about 1.0 to 1.25 diopters; at thirty years of age, to about a 0.5 to 0.75 diopter, and from forty years on, to approximately 0.25 diopter. In other words, the tonicity decreases approximately logarithmically when plotted against the age, hence the percentage loss or rate of loss of tonicity is practically constant. On the other hand, the lag of accommodation is very small in amount in youth and of the order of 0.25 diopter. At thirty years of age it reaches a value of 0.75 diopter and in old age (presbyopic stage of sixty years and beyond) approximates, for the 33.3 centimeters fixation distance, the value of 3 diopters. At thirty years of age, therefore, the tonicity and lag of accommodation each amount to 0.75 diopter. The sum of the values of the tonicity and lag of accommodation at thirty years of age amounts to practically 1.5 diopters. If, then, the dynamic skiametric findings are made by the methods of reversal, as originally advocated by Cross, an average allowance of 1.5 diopters should be made. In toto, these results of Tait, should they be substantiated, will do much to clarify the field of dynamic skiametry."**

From Tait's views it appears to me that the plus spherical power which measures what we have been taught to call relative negative accommodation, represents lenticular tonicity. However, let us not be confused by terminology, but keep clearly in mind the psychology and physiology of vision and understand just what is happening when we put up our lenses or prisms before the eyes.

As to the value of dynamic skiametry, Sheard says: "Whether or not dynamic skiametry is to be accepted as a method of much or little value will depend ultimately on the results of researches on relative accommodation, relative convergence, monocular abberations, effects of pupillary contraction and other phenomena of a dynamic character. At the present time I believe dynamic skiametry affords information, quickly obtained and reasonably accurate, regarding the

*American Journal of Optometry. Vol. 6, No. 11, p. 616. 1929.
**American Journal of Optometry. Vol. 6, No. 11, pp. 618-619. 1929.

accommodative needs of the eyes under examination. The method is essentially a nearpoint test; it is of service in that it affords evidence objectively regarding presbyopia, subnormal or inefficient accommodation, astigmatic corrections at the reading distance and may furnish clues to and partial solutions of latency of hyperopia, spasm of accommodation and interference of extrinsic ocular imbalances with normal accommodative action."

Dynamic skiametry as devised by Cross is much simpler than the newer treatment of the subject as given by Sheard, Atkinson & Woll, Treleaven and Tait. The most complete book on the subject which has yet appeared is Atkinson & Woll's "Dynamic Skiametry." Aspects of the physiology involved and details of the technique which Cross evidently never considered at all, are discussed thoroughly by the authors.

One of the important points raised by the authors is the difference between fixing and focusing in the making of dynamic skiametric measurements. When the patient "fixes" the chart a comfortable accommodation-convergence relation exists—the convergence being the dominating factor. When the patient "focuses," he seeks a clear detailed image and the accommodation is the dominating factor. To me, however, it seems that whatever discomfort an individual would experience from the use of his eyes at close ranges, would arise as a result of an anomalous condition caused by his concentration and effort to seek a clear image. Passive day dreaming would not incur eyestrain. Therefore the focusing-fixating method, to my mind, would constitute the better of the two methods. Recently I have been using both methods, and as yet have never found the great difference between the two that the authors find. In some instances I obtain the same findings, and in others .25 D to .50 D difference.

The essence of the authors' views on dynamic skiametry is set forth in the following:

"It appears, then, that there are two separate and distinct operations and interpretations of dynamic skiametry, according to the method and technic employed.

"1. It determines the point of comfortable working relation between accommodation and convergence, thereby, in most instances, also determining the refractive correction to be worn at that point.

"2. It measures the negative relative accommodation at the point of observation, thus furnishing a valuable means of exploring this flexible element of vision in its various relationships."

The first definition covers their fixation method in which the patient just fixates the target consisting of fairly large-sized characters. The second definition covers the fixation and focusing method in which the patient concentrates on the characters printed on the target. Under this latter method the examiner records his measurements as of the point of reversal, deducts .50 D for lag and 40% of the total accommodation in action as relative negative accommodation. The result is the near point measurement. In the former

the examiner adds plus to reversal and just deducts, in his interpretation, the usual amount for lag. The results of both methods are supposed to correspond, but in the few cases I have tested according to both of these two methods, I find that the fixating method, after the proper deductions have been made from both findings, produces a higher figure in hyperopic cases. The cause for this may lie in the fact that at 13″ 1.35 D are deducted by the authors as negative relative accommodation, whereas many patients between the ages of 25 and 40 do not have as high a negative relative accommodation. This variation in findings does not necessarily change the validity of the authors' theory, but simply corroborates the admonition that dynamic skiametry, like all other ocular measurements, does not in itself produce a prescription.

The following is a summary of the authors' technic:

Simple Fixation Method.

1. Seat the patient as for static skiametry.
2. Use a target consisting of large letters.
3. Start at 40″ distance and move slightly back and forth until a neutral reflex is obtained. If the reflex is "against" and cannot be neutralized at 40″, minus lens are interposed until neutralization at 40″ is obtained and such minus lens power is the measure of the excess myopia over 1 D.
4. If the eye is not myopic, a plus .50 D. Sph. is placed before it and the patient instructed to watch the target.

If movement is now "against," the eye is emmetropic or slightly myopic. If the reflex is "with," the eye is hyperopic and plus lenses are interposed until the motion just starts to reverse. The lens power which caused this reversal is noted. The 40″ position advocated may produce very good results, theoretically, but practically, it is extremely difficult to maintain that position and make the necessary lens changes.

5. The procedure is repeated at 13″. The lens power may be slightly more than at 40″, but if no great discrepancy exists, the patient is considered hyperopic with no presbyopia.
6. The procedure is repeated at the patient's working distance.

One eye is shadowed and neutralized before the other is measured. Treleaven, however, advocates keeping both eyes corrected to approximately the same degree, which appears to be the better procedure.

7. With the spherical correction thus obtained, the eyes are shadowed at the patient's working distance for astigmia, and the patient at this point must try to focus the target. Theoretically, this change in procedure from fixation to fixation and focusing should alter the spherical correction arrived at previously.
8. The patient's amplitude of accommodation is then measured objectively. All lenses are removed. A vertical line of letters is held slightly in advance of the retinoscope, and while the patient is urged to read these, the eye is shadowed. The observer advances

until a neutral reflex is obtained, and with the target moving nearer the patient, the examiner advances until a point is obtained beyond which neutralization can no longer be had. This is the near point which converted into diopters gives the amplitude of accommodation. Of course, the necessary deductions or additions must be made for the patient's defect. Theoretically this method of measuring the amplitude of accommodation appears very sound, but practically its success is doubtful, as it is very difficult for the patient to read the print monocularly with a light reflected into his eye.

9. If presbyopia is indicated the lens which just reverses the shadow from neutrality to "against" by the simple fixation test, less .50 D, is the near correction.

Fixation-Focusing Method.

The chief differences between this method and the simple fixation method are the use of a target with small characters, and the patient's active attention and concentration on the characters. The procedure is the same as in the first method, but the deductions from the lens power which just causes reversal are .50 D for lag and 40% of the accommodation in action—at 40″ approximately .40 D and at 13″ 1.35 D for the negative relative accommodation.

In cases of presbyopia the authors favor the simple fixation method. As yet I have not found any difference in the findings as of the two methods in cases of decided presbyopia.

In discussing myopic cases the suggestion has been made that he treated like a hyperope; i.e., in making the dynamic skiametric measurement, a high minus lens should be put up to create artificial hyperopia and then the error should be corrected with plus lenses.

Let us analyze the condition when this is done. The patient must accommodate while concentrating on the target just as the hyperope does, and just as he will have to do when he wears his static or subjective correction. As we add plus sphere until a point of reversal is reached we neutralize his accommodative excess and his negative relative accommodation, and our measurement at the end is comparable to the measurement of the hyperope, but in our interpretation of our findings, we add .50 D for lag and the estimated portion of the negative relative accommodation, just as we deduct those items in our interpretation of the hyperopia.

Atkinson & Woll believe that the only value of dynamic skiametry in myopia is to determine whether the myopia which was found statically is true myopia or latent hyperopia, and this can be ascertained from the character of the shadow movement. To quote them: "If, on the contrary, it turns out that the static diagnosis of myopia was correct, there is little or nothing of value to be derived from the dynamic test. Muscle and fusion tests should always be carried out in such cases, for in these respects myopes are usually defective. And from the above, the chief value of the dynamic skiametry in

myopia is the determination and measurement of astigmia." This theory is evidently predicated upon the assumption by the authors that the disturbance of the accommodation convergence gives serious discomfort only where the accommodation is in excess of the convergence.

Attention is called to the fact that dynamic skiametry is extremely valuable in measuring astigmia, for the difficulties which beset its measurement in static are absent in dynamic. The pupils are smaller eliminating some of the aberration and scissor movement. The axis of the cylinder oftentimes differs in dynamic from that of static. Woll believes that the axis shown in dynamic skiametry usually proves to be the one accepted by the patient and worn comfortably. Sheard believes the change is due to the tonal condition of both extrinsic and intrinsic muscles when they are in a dynamic condition. This difference in axis makes one wonder whether the cylindric correction can be comfortable under both conditions of the eyes. Atkinson & Woll believe the cylinder axis cannot be correct in both distant and near vision due to this change; but since we use our eyes at close range the greater part of the time, they maintain that the position of the axis should correspond more closely to the dynamic test than to the static test, but the decision as to the position should be made according to the subjective reactions of the patient.

They further believe that the cylindric element should be built up upon the spherical correction as determined by static. Some practitioners, I believe, take the opposite stand, putting up the estimated cylindric correction according to the ophthalmometric findings and then trying to force a skiametric measurement based on that.

The remarks of the authors on the optical element in astigmia are excellent and are quoted as follows:

"As this writer has elsewhere frequently pointed out, there is in reality but one optical element in astigmatism. The classification of this condition into simple and compound hyperopic, simple and compound myopic, and mixed, is merely one of nomenclature, for clinical convenience; and probably confuses the issue more than it helps. These qualitative differences relate, not to the astigmatic but to the spherical element in the error. So far as the astigmia itself is concerned, it consists in one single element, namely, the dioptric interval between the two principal meridians of curvature, which is neither myopic nor hyperopic per se, but simply an interval.

"This being the case, there is no theoretical reason why this interval should be measured as a plus or a minus quantity in preference to the other. Theoretically, it is quite immaterial whether it be regarded as a plus interval and measured with convex lenses, or as a minus interval and measured with concave lenses. If, therefore, there is any practical advantage in one method over the other, then that is the method to be employed."*

*Atkinson & Woll, Dynamic Skiametry, p. 107.

"With" movements are easier to measure than "against." Hence it is oftentimes easier to make a more exact measurement of the spherical and cylindrical errors by converting the whole defect into a plus error with minus lenses and then neutralizing the motion.

The technic in presbyopia is the same as in hyperopia. First a measurement is made at 40″ and then at 13″. If there is a great difference between the two, presbyopia is inferred. As the authors do not note any deductions to be made for lag or for negative relative accommodation, they leave the reader to infer that the lens power shown at the point of reversal is the near correction. Personally, I find that in presbyopes of over 45 or 46 years of age there is either no area of neutrality or perhaps just .25 D.

Another interesting fact to which the authors call attention is the benefit of dynamic skiametry in studying the quantitative and qualitative equality or inequality of accommodation in the two eyes. The technic is the same as that of measuring binocular amplitude of accommodation, but the observer especially notes the points at which the movement changes first from against to neutral, and from neutral to with, as he starts beyond the patient's near point and gradually approaches to within it.

Dynamic skiametry measurements can also be made starting with the patient under fog. Pascal has devised a technique for dynamic fog-skiametry which reverses the procedure most of us have followed. Instead of starting with a "with" motion and working toward neutrality and then reversal, recording the lens power just before reversal, he overcorrects the patient and works from "against" motion to neutrality and to "with" recording the lens just before the one giving "with" motion. A target with large letters is used as the fixation chart. His theory is that by relaxing the accommodation with an increase in plus lenses, an excess relaxation takes place not giving the true physiologic locking point between accommodation and convergence, but by making the measurement from a blurred point to a clear point, the point of comfortable accommodation-convergence can more exactly be determined.

"Lag of accommodation," of which Sheard has written so frequently, is now taken up and Southall's explanation of its cause is offered. This is taken to be the monochromatic aberrations of the human eye which produces a caustic reflection of light. Hence a purely optical explanation of the difference which has been observed by many investigators between the static and dynamic findings of an orthophoric emmetrope. Although it would be interesting and beneficial to the profession to ascertain the true explanation of this phenomenon, its discovery is not absolutely necessary before one can use dynamic skiametry in his refractive procedure. The dynamic skiametric measurements are never absolute and their significance can only be ascertained in the light of other diagnostic data such as

static measurements, near point ductions, near point phorias, cross-cylinder findings, etc.

In the May 3, 1929, issue of "THE OPTICAL JOURNAL AND REVIEW" there appeared a splendid article by Mr. C. L. Treleaven of Columbia University, entitled, "Practice of Dynamic Skiametry."

Mr. Treleaven advocates a careful analytical study of the reflex for the presence of any irregularities or opacities, since at the 13" working distance advised by him these can be observed more readily than during the static measurements or the ophthalmoscopic investigation. The steadiness of accommodation is also shown by the behavior of the reflex.

As plus lenses are added, in the case of hyperopia or presbyopia, the motion changes from a with to a neutral condition, and finally to an against motion, which is called the point of reversal. There is, however, an area which may be called a neutral zone in which the reflex remains neutral although plus lenses be added. This he terms the "neutral zone."

Both eyes are measured simultaneously, the general character of the motion being kept approximately the same to produce an equal amount of ciliary activity in the two eyes. You recall that Woll & Atkinson neutralize the movement in one eye before shadowing the other.

Mr. Treleaven explains what appears to me to be a very splendid method of ascertaining the correctness of the sphero-cylindric combination in front of the eyes. This consists of withdrawing from the position of measurement, after neutrality has been obtained, noting the against motion in the principal meridians, and slowly approaching the original position, observing the two principal meridians to see if the motion changes equally to the original neutral one. If there is not equal change in the motion, the cylinder is changed accordingly. This seems to be a very valuable method of checking the exactness of the astigmatic correction. After this is done for each eye separately, the examiner withdraws and shifts the beam from one eye to the other to determine whether the motion fades from "against" to "neutral" at the same time in both eyes. This equalizes the accommodative effort in both eyes.

The amount of lens power in front of the eyes when the point of reversal has just been reached includes the distance findings plus the "add to reversal" (the author's term), which would be the presbyopic add in cases of presbyopia, latent hyperopia in younger patients and negative relative accommodation. However, this total "add to reversal" is not necessarily prescribed.

The author's interpretation of the "add to reversal" is, according to his own statement, empirical, the result of experience rather than of theory. He states that he has found in many cases of young emmetropes (or practically so), that the dynamic measurements at

13″ will show a plus 1.50 D lens at the point of reversal, although no part of it may be needed as a near addition. More than 1.50 D will be found in presbyopes, latent hyperopes and pseudo myopes. When more than 1.50 D is found, the differential diagnosis between latent errors and premature presbyopia will have to be obtained from other data.

Quoting the author: "With experience in observing the appearance and behavior of the 'reflex' as the dynamic test proceeds, one soon learns to distinguish between the 'reflex' of an eye having an active accommodation which does not relax in the distance and that of the presbyopic eye (including the so-called premature presbyope), even though the lens value which produces 'reversal' may be nominally the same in both." By this he may refer to the fact that in some instances we find the "reflex" to be "neutral" with a slight addition of plus and then rapidly to change to a "with" movement, this phenomenon continuing through several lens changes; whereas in the average case of presbyopia, there is a decided condition of the reflex which does not fluctuate but remains "with" until the necessary lens power has been added, at which time it becomes definitely neutral.

To further quote the author, "the 'add to reversal' is an objective measurement of the maximum lens assistance acceptable to the patient wearing his distance correction and focusing or attempting to focus at 13″. If this 'add to reversal' is less than one-third of the patient's amplitude of accommodation, no part of it is needed as a prescribed 'add' for close work; if on the other hand the 'add to reversal' is more than one-third of the patient's amplitude of accommodation, then such patient will have comfort over protracted periods of close work only if he be given, as a prescribed 'add,' the lens power indicated by his 'add to reversal' excepting a part which must at all times be less than one-third of his available amplitude of accommodation."

Again let me compare these statements with Atkinson & Woll's. You recall they advocate the deduction of 40% to 45% of the accommodation in action, as well as .50 D for lag, from the dynamic findings at the point of reversal, using the focusing-fixating method at 13″.

Let us take, for instance, a patient of 60 years of age. At 13″ three diopters of accommodation are necessary, but he has only a total amplitude of one diopter. By dynamic skiametric measurements a plus 2.75 D "add to reversal" is found; i.e., plus 2.75 must be added to the static findings or the distance rx, to obtain the point of reversal. Less than ⅓ of the available amplitude would be .25 D. Plus 2.75 D less .25 D gives plus 2.50 as to presbyopic add found by dynamic skiametry.

The author makes a statement which to me seems to be a con-

tradiction to the rule he sets forth for determining the amount of the add, necessary. He states, "if an 'add to reversal' of plus 2.75 D is found at any time then, irrespective of age, there is indicated a difficult accommodation at 13" and the need of the prescription of a considerable 'add' for close work *to the extent of about 2.50 D.*" (The Italics are my own.) But if we take the case of a patient of 30 years showing 2.75 D "add to reversal," deducting less than ⅓ of the available amplitude, namely 2.25D. (⅓ of 7.5D being 2.5), there leaves but .50D as an indicated add for near. However, the author nullifies to a considerable extent the importance of this discrepancy by stating that in the case of a latent error, it is not of prime importance to know the exact amount of the latency, but it is important to become cognizant of the existence of a considerable latency.

A table is given to be used for quick ascertaining of the necessary add:

Observed Add to Reversal	Indicated Available Amplitude	Portion of "Add to Reversal" not Prescribed	Portion of "Add to Reversal" as add for 13"	"Add" for Usual Close Work
1.50	5.00 or more	1.50	0.00	0.00
1.75	4.50	1.00	.75	.25
2.00	3.50	.75	1.25	.75
2.25	2.50	.50	1.75	1.25
2.50	1.50	.25	2.25	1.75
2.75	1.00	.25	2.50	2.00
2.87	.62	.12	2.75	2.25
3.00	.37	0.00	3.00	2.50

In the case of myopia, the dynamic findings would correspond to those obtained in hyperopia, if either of the two procedures to be described is followed: first, if the static findings are obtained first and left in the trial frame or phoropter, and the examiner proceed to the dynamic measurement a with motion would be found taking plus lenses to neutralize, and the record would be made as of the lens power when the beginnings of an against motion is obtained; second, if the dynamic measurement is made without any lenses in the phoropter and record is made as of the first neutralizing lens. In this manner the dynamic findings made in hyperopia and in myopia correspond, both include the negative relative accommodation. This point, I believe is in variance with the instruction many of us received as students in college, for we were taught that the dynamic skiametric measurement consists of the first neutralizing lens power in both myopia and in hyperopia. The great reduction in minus usually encountered in the dynamic skiametric findings in myopes is caused by the fact that our measurement, as of the first neutralizing lens, includes the negative relative accommodation.

Since studying Mr. Treleaven's article I have been noting in many cases, in my dynamic skiametric measurements, first the lens value which first neutralizes the shadow, and then the lens value at the point of reversal. I find, however, that in most cases only from .25 to .50D can be added to the first neutralizing lens to obtain the

point of reversal and this does not give as high a value as 1.50D as the "add to reversal." However, I have also observed that my dynamic measurements as of the first neutralizing lens are usually from .50 to .75D higher in plus than that of other practitioners—perhaps due to the fact that I work in a semi-darkened room and use a fairly strong retinoscope light, which tend to produce more relaxation.

Credit, I believe, is due Mr. Treleaven for having written a most practical paper on dynamic skiametry, which has the merit of being understandable and complete.

DR. ARENE T. WRAY,
3204 W. SIXTH ST.,
LOS ANGELES, CALIF.

BIBLIOGRAPHY

Cross, Dynamic Skiametry in Theory and Practice.

Atkinson & Woll, Dynamic Skiametry.

Bulletin of Lectures, Annual Convention, California State Association of Optometrists, June, 1928.

Optical Journal and Review, May 3, 1929, Treleaven, Practice of Dynamic Skiametry.

OCULO-NEURAL CONNECTIONS AND SPINAL ADJUSTMENTS*

H. N. Smith, D. C., Opt. D.
Sioux Falls, South Dakota

It has long been the aim of the writer of this article to bring about a closer cooperation between Chiropractors and the Optometric profession. Many of our thinking Optometrists, I have felt, have reflected along this line of natural affiliation but have been modest in the advancing of such ideas. This is due partly to lack of information as to just how Chiropractic spinal adjustments can affect the eyes, and more or less to a fear of creating antagonisms with the medical profession.

This article does not go into the minutiae of the various nervous connections, but aims to give the Optometrist a readily assimilable picture of how Chiropractic spinal adjustment reaches the eye and can aid in correcting certain cases of strabismus, asthenopia, muscular imbalances, hordeoleum, iritis, conjunctivitis, blepharitis, blepharism, et al. And, from a perusal of Optometric literature in the last few years, Optometrists, I believe, are certainly working toward a point where they are unconsciously recognizing the Philosophy of Chiropractic.

There are twelve cranial nerves. Five of these have directive powers in the functioning of the Optometric forte, that which deals with the most wonderful organ in the human body, viz., the eye.

The optic nerve may be considered the most important; and as such we'll treat of it first. The optic nerve, consisting of about forty-five bundles of fibers, may be divided into three parts: (1) the optic nerve proper, beginning at the anterior part of the optic commissure and passing forward expanding into the retina; (2) the optic commissure, resting upon the olivary process of sphenoid bone; and (3) the optic tract. The optic nerve itself is about one and a half inches long; about ten inches being the length of all three parts. It is the second in diameter of all nerves in the body—the sciatic being first. It is different from any other cranial nerve in that it is a prolongation of brain substance—Pillsbury says that the retina is a part of the brain that in the course of development has come to the surface. From the chiasm, fibers of the optic nerve pass back to the pulvinar body as the optic tract, which tract has two roots, one arising in the pulvinar body and the other in the middle geniculate body. The nerve fibers pass through the pulvinar body and then through the lateral geniculate body to the occipital lobe—these fibers being called optic radiations or association fibers of cerebrum. From occipital lobe of cerebrum, fibers pass forward to the optic thalamus. Fibers from the pulvinar and the lateral geniculate bodies connect

*Submitted for publication Oct. 21, 1929.

with the superior quadrigeminate body, as do corticifugal fibers from occipital lobe of cerebrum, which in turn connect with nuclei of oculomotor, trochlear and abducens nerves.

It is through these connections with the third, fourth and sixth cranial nerve nuclei, particularly the third cranial, that Chiropractors affect the optic nerve by adjustment of the upper cervical vertebrae; inasmuch as these three nerves are found to have direct connections with the sympathetic system, which system in turn is connected with all of the cervical spinal nerves, and properly speaking is a part of them. Aside from the above connections that exist, as we say, internally, the tissues which surround the eyeball, such as adipose and fibrous elements, as well as orbital muscles are supplied by nerves whose connections with spinal nerves are distinct.

The third cranial—oculomotor—arises deeply by seven nuclei in the floor of the aqueduct of sylvius. Each specific nucleus gives rise to fibers that specifically supply a certain muscle (internal rectus, ciliary body, levator palpebrarum superioris, superior rectus, inferior rectus, inferior oblique, sphincter of iris). Through its connection with ciliary ganglion, situated just posterior to the eyeball, this nerve supplies the ciliary body, iris and cornea.

Fibers from the nucleus of the abducens nerve communicate with the nucleus of internal rectus of the oculomotor nerve; thus each of the nerves of the oculomotor may act independently of all the other nerves of the same side but not independently of those of the opposite side.

Spinal adjustment in the upper cervical region, chiropractors claim, affects this nerve through rami-communicantes which connect the spinal nerves with the sympathetic cervical ganglia. This gangliated tissue then proceeds through the carotid canal forming the cavernous plexus and passes to the nuclei of oculomotor, trochlear and abducens nerves. The ophthalmic division of the fifth cranial nerve sends a communicating branch to the oculomotor nerve, this ophthalmic division in turn being connected with the sympathetic system.

The trochlear, or fourth cranial nerve, has four peculiarities, viz., it is the smallest nerve in the cranial cavity, is the highest in situation in the orbital cavity, has a complete decussation, and is the only nerve having a posterior origin at the base of the brain to cruri cerebri. It communicates with the cavernous plexus by several branches which are formed by fibers of the superior sympathetic ganglion, which in turn communicate with the cervical spinal nerves. It communicates also with the ophthalmic division of the fifth cranial nerve. Thus it establishes a direct continuation of fibers from the spinal cord.

The trifacial nerve, or fifth cranial nerve, consists of three divisions known as the ophthalmic, superior maxillary and inferior maxillary. The ophthalmic division is joined in the cavernous sinus by

branches from the cavernous plexus of the sympathetic system and communicates also with the oculomotor and abducent nerves. The ganglion associated with this nerve also communicates with the glossopharyngeal; and through this and its several communications with the facial and motor oculi it supplies many important organs.

The sixth cranial or abducens. This nerve arises in the floor of the fourth ventricle. Its fibers cross and supply muscles of the same side, intertwining with oculomotor fibers. The internal and external recti thus function so perfectly in unison because of having the same nuclei for a source. The abducens nerve is the simplest of nerves, being uncommon in that it loses its identity in the external rectus muscle.

Adjustment of subluxated vertebrae in the upper cervical spine releases pressure on the spinal nerves which emit at those points, with the result that these nerves transmit fuller and perhaps faster flow of mental impulses (nervous energy). This increased mental impulse-flow passes through the sympathetic nervous system and from the plexuses Carotid and Cavernous and one branch of the Ophthalmic division of the Trifacial nerve and normalizes the nerve supply to the eye and its appendages. When the eye or any other part of the human body receives the 100% flow of mental impulses, other things, of course being equal, health is the result.

DR. HERBERT N. SMITH,
SIOUX FALLS, SOUTH DAKOTA.

BIBLIOGRAPHY

Physiology of the Nervous System - - - - - - - - Morat
Psychology - - - - - - - - - - - - - - Pillsbury
Anatomy - - - - - - - - - - - - - - Cunningham

OCULAR ELECTROTHERAPY

J. I. Kurtz, B. S., A. O., F. A. A. O.
Minneapolis, Minn.

WHAT PHYSICAL THERAPY MAY ACCOMPLISH FROM AN OPTOMETRIC STANDPOINT

Chapter XIV.

We know that certain physical therapy agents will cure rickets, tuberculosis, pneumonia and other pathologic conditions, but as optometrists we are not interested in the treatment of pathology. What we are interested in is what will physical therapy do for Optometrists? It will accomplish very good results in most optometric cases if properly applied. It is true that this science is new and very little research work had been done to study the effect of the application of physical agents to the eye. Both ophthalmologists and optometrists are equally guilty for neglecting to develop this new and promising field. However, a little research had been done recently and the results are so promising as to encourage all of us who are interested to go a little farther into this study and research.

It may be of interest at this point to learn about some of the cases that were treated with physical therapy as well as of the results obtained. Sties and tumors of the lids have repeatedly been treated successfully through the application of high frequency currents. In cases of pseudo myopia and progressive myopia where these conditions are due to lack of calcium content in the blood, the application of physical therapy, particularly ultra violet light, will tend to correct this condition and offers a favorable field for study and further research.

Physical therapy will also (in some cases) establish normal color fields and form fields and remove scotomas of long standing. Dr. Koch reports a case of a woman, age 30, whose fusion reserves were very low and to whom treatments were given over a period of several months. This patient had a small positive scotomata with a somewhat larger relative scotomata extending nasalward from the positive area. In this case the macular area was not itself directly involved and the usual fusional development treatments were administered, as well as an application of high frequency for a period from three to five minutes at the start of each treatment. At the conclusion of the treatment series, Dr. Koch reports a complete absence of the positive scotomata with a marked reduction in size of the relative scotomata for both red and green.

Muscular imbalance cases, while we do not claim that they will completely be cured by the application of physical therapy, will, however, greatly benefit by its application. In searching for a cure for muscle imbalance cases one must first find the cause. Duke Elder that famous research worker of London gives us five possible

causes of muscular imbalance:

1. Weak muscles.
2. Spasm of an opposing muscle.
3. Errors of refraction and disturbances of accommodation with associated convergence.
4. Abnormal anatomical arrangements of muscles or configuration of the orbit.
5. Disturbances of innervation.

While there may be other classifications of the causes responsible for muscular imbalance, personally I think that the causes as enumerated by Duke Elder are as accurate as any others.

Now, let us analyze the causes and see what physical therapy will do in these cases. The first cause he mentions is a weak muscle. This I think is rather *an effect* and *not a cause.* The real cause is the one listed under number five, i. e., disturbance of innervation. When a muscle does not get the proper amount of energy due to the disturbance of innervation the muscle becomes weak. There is not a better agent in existence for the establishment of normal innervation than physical therapy. This is a proven laboratory as well as clinical fact. Now, let us take the second cause, namely, spasm of an opposing muscle. All of our present day authorities agree that diathermy is the most effective agent for the relief of spasmodic conditions. The third cause mentioned by Duke Elder is errors of refraction and disturbances of accommodation with associated convergence. From our experience as optometrists, we know that lenses, prisms, and oculo-prism treatments are most effective in cases of this kind. And what is the application of lenses, prisms and oculo-prism treatments if not the application of physical agents?

The fourth cause he mentioned is anatomical arrangements of muscles or configuration of orbit. In cases of this type, I don't think that physical agents will be of much value. In reviewing the classification of causes of muscular imbalance we find that physical therapy is of great help to all muscular imbalance cases which are due to four out of five causes given in the classification.

For the relief of pain and headaches, physical therapy has no equal. Some of these cases successfully treated by myself and others will give you an idea as to the effect of physical therapy in cases of pain or headaches.

A case of interest is Mrs. M. E., age 55, who called at my office for a refraction November 10, 1928, complaining of severe frontal and temporal headaches and intra-ocular pains. There was no refractive error present other than the usual presbyopic condition at her age. She had 6 P. D. of exophoria at distance and a very low duction and fusion reserve power. At first we were inclined to think that her pains and headaches were due to some other cause and advised her to undergo a physical examination. We were then told that she

is now and has been for the last few years under the care of one of the leading medical specialists in the state, and that he has done all that is possible for her. This statement was confirmed by her physician in his report to me about her physical condition. I then decided to give her a course of oculo-prism treatments. The first treatment was given on November 15, 1928. This was preceded by a fifteen minute application of high-frequency using the sedative technique. After the treatment I explained to the patient that she might feel the after-effects of the oculo-prism treatment. To my surprise, she reported when she came to the office on the 17th (the treatments being given every other day) that immediately after the first treatment the headache and pains left her and did not return for about thirty hours.

Another oculo-prism treatment was then given and this was preceded by a fifteen minute application of diathermy as was the first. This technique was repeated for four times on alternate days. After the fifth treatment, the patient reported complete relief from headaches and pains, which have not reoccurred to date. There is also a considerable improvement in her duction power.

A number of investigators have found physical therapy as a very effective means not only for the arrest of the development of cataract, but for the treatment and cure of cataract cases as well. Cox reports a number of cataract cases successfully treated as follows:

Mrs. S., age 60, blinded by cataract in the left eye three years. She was just able to see sufficiently to get about with difficulty with the right eye which showed cataract very clearly. She came to find out if a lens would help her vision in the best eye. She was encouraged to try diathermy treatments. Hope was held out for the seeing eye. She consented to make the suggested trial. Auto-condensation current was used for a few days until the murky skin cleared. Then diathermy thirty minutes daily, increased five minutes each time until 45 to 50 minutes.

Mrs. R. S., age 77, vigorous for her age, came for refraction in 1925. Right eye fundus clear, vision 20/20 with plus 3.00 D. S. lens. Read easily with + 2.50 D. S. addition. Left eye patient said had never been good. But little of the fundus was visible on account of white cataract with yellow tinge. Very little vision with + 3.00 D. S. The same addition was prescribed for harmony. Patient reported again January 6, 1926. Complained of total sense of blackness on left side and dimness in right eye. Fundus could not be seen. The cataract was more a yellow brown, the right eye showed cloudiness of lens. Consented to take treatments for cataracts. After several treatments right lens was more clear and vision normal, i. e., 20/20 and some improvement in left eye. Patient then said the eye was as good as it ever was but an ophthalmoscopic examination showed irregular markings of cataract. She was advised to continue treatments. She promised to return later, which she did after two

years and nine months. She then said vision was getting worse for the last three months. Treatments were again given same as the first time and a marked improvement was the result.

Mrs. L., age 71, health good. Right eye media clear and vision 20/20 with plus 3.00 lens. Left eye amblyopic light perception only. Absolutely no vision of forms, similar plus 3.00 bifocals with 2.50 adds were ordered. Reported within one month some vision of forms with left eye. Came again June, 1926, complaining of fogginess and could not read. Ophthalmoscopic examination showed very cloudy lens in right eye. Five diathermy treatments of which the first was only 25 minutes were given, the remaining four were 45 minutes diathermy and four minutes surging sinusoidal with five volt strength. The right eye completely cleared with full 20/20 vision and has remained so to July, 1928. Left eye showed decided improvement in vision and has continued to improve until she could read letters one-fourth of an inch high.

S. H., a shipyard laborer, age 42. Cataracts discovered in left eye in 1917, eliminating him from service in United States Army. In 1924 right eye examined by oculist. Diagnosis: Beginning cataract, refracted and glasses prescribed on account of high compound myopic error. Came for treatment October, 1927. Both eyes revealed definite cataracts rendering vision very difficult. Physical condition good. Took fifteen treatments. Right eye was entirely cleared of cataract and fundus visible. Left eye field of vision clear but some cataract on temporal side. Patient had no money to live on and went to work, agreeing to return later.

A. B., age 75. Treated for cataracts ten years ago. Came for treatment in February, 1928, and had to be led into the office. Took fourteen treatments within thirty days. Went to work on his farm and now drives to town occasionally.

Wm. C., age 70, good physical health. Cataracts in left eye, light perception only. Right eye, through a very small opening on temporal side could just make out big E at two feet. Vision improved with treatments three times a week. Vision after fifty-second treatment 20/50, enabling him to carry on his farm work.

Mrs. S. J., age 50, splendid health, complains of cloudiness of vision. Past three months growing worse rapidly. Examined with ophthalmoscope. Cataracts, grayish white over whole of lenses. Treatments produced no change in the progress of the trouble. Case was given up as not amendable to electric treatments."

Cox is not the only one to report success with the application of Physical Therapy in cataract cases. There are many other men, medical practitioners as well as optometrists, who have been using this form of therapy. In my recent lecture tour East, I met a considerable number of optometrists who were using Physical Therapy for some time and they were reporting successful results in the treat-

ment of cataract cases. In some instances they were able to arrest the further development of the cataract and in others again they were able to absorb the opacities altogether.

Drs. Hollander and Cottle claim that medical therapy in cataract cases has proven to be a complete failure and that therapeutic electric currents hold out some hope in certain cases. This belief is being held by many other investigators and considering the benefits which may be derived from the use of Physical Therepy in these cases, it is certainly worth while to give this subject further study and investigation. It is maintained that the advantages of this form of therapy are:

(a) That a larger percentage of cataract cases are curable by Physical Therapy treatments than by any other form now known.

(b) It is one of the most pleasant forms of treatment.

(c) There is a marked improvement in the patient's mental and physical condition, including blood pressure symptoms, dizziness, nervous subjective and often irritable feelings of depression.

(d) It improves visual efficiency as well as visual comfort.

(e) It makes the lens more elastic and capable of overcoming hyperopia and in some cases causes the disappearance of lenticular astigmatism.

(f) It saves the patient from the mental depression during the period of increasing darkness with its accompanying despair during the waiting period for the cataract to mature.

(g) It opens up an enormous field for further usefulness and development for the relief of the many ailments of the human eye.

Amblyopia, another condition which has for a long time proven to be a stumbling block seems to respond very favorably to Physical Therapy treatments. Cox and others have a number of successful cases on record. I, personally, had a very interesting case of amblyopia which was treated successfully and it may be of interest to record it here.

Mrs. T., age 52, called for a refraction June 13, 1929. She claimed that the left eye had been blind for several years and that she has been losing the sight of the right eye for the last few months. She visited several ophthalmologists but was told nothing could be done to save the sight of the right eye. The ophthalmoscopic examination revealed atrophy of the left optic nerve. The fundus of the right eye was apparently normal, with a slight cupping of the disc. Static skiametry O. D. — 6.00 D. Sph. ⊃ 3.00 D. Cyl. Axis 30. O. S. — 9.00 D. Sph. Dynamic Skiametry O. D. — 3.50 D. Sph. ⊃ — 3.00 Cyl. Axis 30. O. S. — 7.00 D. Sph. Vision without lenses O. D. Fingers at 8 ft. and O. S. light perception only. Vision with static skiametric findings was O. D. 20/200; O. S. light perception only. The correction worn for the last 12 years was O. D. — 4.00 Sph. ⊃ — 4.00 D. Cyl. Axis 180 V. = 10/200; O. S. — 8.00 D. Sph. which did not

improve vision. The case was diagnosed as a case of amblyopia in the right eye and amplyopic treatments were instituted. A combination of physical agents consisting mostly of high frequency and diathermy of varying techniques were used, the treatments were given twice daily, for a period of one month. The following lenses were prescribed: O. D. — 4.50 D. Sph. ⊃ — 4.50 D. Cyl. Axis 30; O. S. — 9.00 O. Sph. During the first two weeks there was little improvement in her vision, after this period improvement was rather rapid. The notes on our records are as follows: July 1, 1929, with above correction O. D. V = 20/100 O. S. no change during the entire treatment period; July 5th, O. D. V = 20/70; July 9th, O. D. V = 20/50; July 13th, O. D. V = 20/40. The patient being a farmer's wife living a few hundred miles from Minneapolis had to return to the farm at this time, although she expressed the desire to continue the treatments for a longer period and she promised to return for treatment within the next three months as soon as the farm work would be completed. On October 21, 1929, the patient again reported at the office claiming that the sight is not nearly as good as at the time the treatments were discontinued. Upon examination it was found that the acuity of vision in the right eye had dropped to 20/100 during the three months she was away. A search for the cause of the reduction in visual acuity had been made as I suspected some foci of infection and while the patient claimed to be strong and healthy and looked the part, she was sent to a reliable physician for a complete medical examination. The report of the examination was that there are some definite foci of infection present and the patient was advised to have that condition attended to. Treatments of ocular physical agents were again instituted and the sight was gradually improving. Her vision in the right eye was 20/25 on December 12, 1929. On account of sudden sickness in the family, treatments were again discontinued at this time but may be resumed later.

Use of Physical Therapy May Prevent the Development of Pathology.

Helmholtz, DuBois-Raymond and other more recent investigators have shown that when a muscle is overworked, special toxic substances are produced which cause fatigue of the muscular and nervous system.

Abelous thinks that fatigue causes a sort of auto-curarization, or paralysis of the terminal motor plates of the nerves which actuates the muscles. The synapsis become more resistant to the passage of the nerve current when the axons and dentrites are affected by toxins due to fatigue, or drugs, etc. This causes a slowing up of the nerve energy flow. The muscles which depend for their nervous energy upon these affected nerves suffer and fail to function properly. ***This stage marks the beginning of a condition known as physiological inactivity, which if not cared for promptly will develop into a condition of pathologic inactivity.*** As mostly all pathologic

conditions are preceded by a condition of physiologic inactivity, it becomes of extreme importance, from a preventative standpoint, that something should be done to restore the normal nerve energy flow across the synapse to the muscle, to reestablish normal physiologic activity and thus prevent the development of pathology. Almost all authorities agree that the proper application of physical agents such as therapeutic currents, massage, exercise, etc., will help remove the condition which caused the synaptic resistance and the blocking of the nerve energy flow which in turn is responsible for the development of the physiological inactivity.

From the preceding discussion, we may safely conclude that the proper and timely application of ocular physical therapy by optometrists *as a compliment* with other accepted optometric techniques will not only be a great help in the treatment of ocular abnormalities such as amblyopia, cataract, muscular abnormalities, astenopia, etc., but it will help prevent the development of pathology. It will thus open up a new field in preventative Optometry.

DR. J. I. KURTZ,
209 MEDICAL ARTS BLDG.,
MINNEAPOLIS, MINN.

AMERICAN JOURNAL OF OPTOMETRY

VOL. 7 FEBRUARY, 1930 NO. 2

EDITORIAL STAFF

DR. CAREL C. KOCH, Editor
209 Medical Arts Bldg.
Minneapolis, Minn.

DR. JACK I. KURTZ, Associate Editor
209 Medical Arts Bldg.
Minneapolis, Minn.

Original papers, scientific communications, clinical reports, society proceedings, books for review, and correspondence should be sent to the Editor.

Annual Subscription, $3.00 in Advance. Canada, $3.50. Foreign, $4.00. Single Copies, 40c.

Copy of advertisements must be sent in by the tenth of the month preceding their appearance. Subscriptions, applications for single copies, communications with reference to advertising or other business should be addressed to the Business Manager, Dr. Jack I. Kurtz, 209 Yeates Building, Minneapolis, Minn.

Published Monthly by the American Journal of Optometry Publishing Association.

The Journal has no objection to the reprinting by other magazines of any of its articles, provided such reprints are properly credited to the American Journal of Optometry.

DISCOLORATION OF METAL AND THE BLACKENING OF THE SKIN

As users of precious metals, we, as optometrists, are occasionally confronted with the discouraging and at times embarrassing situation which arises when material which we have prescribed becomes discolored and which in some instances has a tendency to blacken the skin upon which this material has been resting.

There are several reasons for this discoloration and with the wide spread use of white gold material, the writer believes it is essential for every optometrist to understand the various factors which may produce this discoloration, and the blackening of the skin which frequently accompanies it.

In the first place let me say that many people have the mistaken idea that "good" gold material ought not discolor or oxidize under any condition, while as a matter of fact, even pure gold, i.e., 24 carat gold, changes its color under certain circumstances. But just as soon as the gold is alloyed with other metals, it is bound to discolor all the more easily. Climatic or atmospheric conditions can be the cause of this discoloration, for instance, air containing gasses to an unusual extent or chemical vapours may be responsible for it. Naturally, the contact with all sorts of chemical substances or even with other metals, is still more apt to affect gold and gold-filled spectacle material. Also the occupation of the wearer may account for the discoloration; for instance, chemical, electrical or mechanical engineers are bound to expose their spectacle frames to all sorts of conditions which may affect them.

Another frequent cause for discoloration of spectacle material and the blackening of the patient's skin is to be found in the use of cosmetics and of external as well as internal cures. This, according to an annotation in the Commonwealth Optometrist*, is a most frequent source of trouble, for even minutely small doses of various poisons will discolor the material. This is particularly true of mercury, which is frequently contained in these mixtures and cosmetics. Mercury causes small greysh-white spots, which an expert can easily remove by a slow process of heating. Apart from cosmetics and medicines, however, a surprisingly large number of people have certain strong acids in their system, some from birth, others through diet and nutrition. The general state of health may also account for it. Under trying weather conditions, the effect of such acids is particularly noticeable, as the discoloration or corrosion will be all the greater if the wearer perspires freely. Skin troubles of a more or less serious nature are, of course, also frequently responsible for the discoloring of the frame material. The medicines, salves, lotions, etc., prescribed for ailments of this kind invariably contain substances which affect, and sometimes even ruin spectacle material which is in constant use. It is also quite a common experience—in some sections of the country, of course, more than others—for climatic conditions alone to produce a marked influence in this respect, that certain patients cannot wear gold or gold-filled spectacle material because of a pronounced blackening of the skin due to the presence of certain acids which are eliminated through the skin. It must be emphasized, however, that all this is perfectly natural, and persons so affected should not feel in the least sensitive about it.

Gold, of course, is very often alloyed with copper, and the more of this red metal which is alloyed with the gold, the more reddish becomes its own color. Red gold, it is said, tarnishes more quickly than gold alloyed with other light or whitish metals. It follows, of course, also that 8 or 9 carat gold discolors much more rapidly than 14 or 18 carat gold.

It is also interesting to note that when gold or silver is brought into contact with certain dyed materials, the gold or silver will discolor very badly, for dye stuffs frequently contain either sulphur or chloride. Particularly silver is affected in this way and turns blue, black or brown if wrapped up in material such as flannel containing chemical elements of this kind. In most cases, it is quite impossible to remove stains of tarnishing by mere wiping, but by dipping them into a weak solution of cyanide of potassium, the discoloration disappears instantly.

In this connection it might be well to say that it is essential to pack or wrap frame material made of gold or silver in paper which is absolutely free from chloride and sulphuric substances; even the smallest traces of sulphur or ammonia of cyanide will cause discoloration.

---

*November, 1929. Page 19.

In view of all the above, it stands to reason that complaints on the part of patients because of discoloration of material made of gold and silver are absolutely inevitable. It is also obvious that in the great majority of cases, the complaints, while perfectly bona fide, are entirely due to inexperience. It is equally clear, that with rare exceptions the optometric practitioner is just as little to blame for discoloration, tarnishing or corrosion as is the manufacturer. The writer therefore suggests that the causes of the discoloration and the means of its avoidance be explained to the complaining patient. A reasonable patient will then invariably realize the conditions, and at least acquit the practitioner of all responsibility. Patients who have had the unfortunate experience of having their white metal frames discolor and patients who have experienced the blackening of the skin which at times accompanies the wearing of precious metals, should have these factors brought out clearly to them and should whenever possible be persuaded to assist you in correcting whatever may be the individual cause so as to enable them to continue using the material of his or her choice.

C. C. K.

BOOK NOTICES

PRACTICAL INDEX TO ELECTRO AND PHOTO-THERAPY. Joseph E. G. Waddington, M. D. Published by A. M. Margraf and Company, Detroit, Michigan. 401 pages, 160 illustrations. 1929. Price $7.50.

Practical index to electro and photo-therapy by Dr. J. E. G. Waddington was rewritten and republished in 1929. After reading the first few pages in this book, one's attention is immediately attracted to the manner the author handles the subject-matter. It shows a very broad knowledge of the subject which he presents in a very simple and interesting style.

The book contains 21 chapters. In these chapters the author discusses the different kinds of therapeutic currents and explains fully the physics, biophysics and the technique of application of each type of a current. To discuss this thoroughly the author takes up the first 15 chapters. In the six remaining chapters, the author explains fully the use of photo-therapy. Here again he discusses fully the physics and biophysics before he describes the techniques.

In the last part of the book, the author gives a selective chart of electro and photo-therapy agencies. In this index he takes alphabetically the different types of diseased conditions and suggests a certain form of treatment and technique.

J. I. K.

ANNOTATIONS AND SOCIETY PROCEEDINGS

The American Journal of Optometry is the Official Organ of the American Academy of Optometry, as well as the Organ of the Arkansas, Delaware, Indiana, Iowa, Maine, Maryland, Michigan, Minnesota, Nebraska, North Dakota, Oklahoma, Pennsylvania, South Dakota, Vermont and West Virginia Optometric Associations.

The following gentlemen have consented to supply items of interest from their respective sections, acting in the capacity of

ASSOCIATE STATE EDITORS

DR. E. B. ALEXANDER
Duncan, Okla.
DR. A. S. ANDERSON
Minot, N. D.
DR. J. F. ANDREAE
Baltimore, Md.
DR. R. W. BENNETT
Indianapolis, Ind.
DR. C. H. DEGRAFF
Monroe, Mich.
DR. L. P. FOLSOM
South Royalton, Vt.
DR. D. L. GALLAGHER
Parkersburg, W. Va.
DR. D. A. KINNEY
Charles City, Ia.
DR. A. J. LARGE
Winona, Minn.
J. J. LIVINGSTON
Little Rock, Ark.
DR. M. B. MEYER
Wilmington, Del.
DR. J. K. MORRIS
Erie, Penn.
DR. C. A. PERRIGO
Norfolk, Neb.
DR. D. E. PLAISTED
Lewiston, Me.
DR. H. N. SMITH
Sioux Falls, S. D.
DR. H. R. SPITLER
Eaton, Ohio

COMMENTS ON OCULAR "MUSCLES"

Dr. W. H. Glazer, Optometrist of Philadelphia, writes:

"I suppose there are many besides myself who have been sitting back and listening to theories, weird formulae, and, perhaps, more weird technique advocated in respect to ocular muscle imbalances. Occasionally we sit up or stand up under shock stimuli only to fall back in a daze. Either we are incompetent to receive the messages as given to us up and down the land, or the messages are so much "hokum" in the main, with here and there a grain of truth.

"At any rate, here's how I see matters in respect to ocular muscles.

"The factors involved, besides the muscles themselves, are the second, third, fourth, fifth and sixth cranial nerves or their branches; the quadrageminal bodies, optic thalami, and visual sensorium; the cerebellum and corpus striatum; the blood and lymph systems; the refractive apparatus; the seat of consciousness, association processes and heredity. These are probably not all-inclusive, but inclusive enough.

"Grouping the factors in another way, we have to regard the anatomical, physiological, pathological and psychological conditions, normal, subnormal and abnormal.

"Obviously, it would be quite impossible to deal with the respective factors. It will suffice, however, to point out some salient facts that ought put us on our guard in accepting or rejecting some of the stuff that comes our way.

"There isn't any doubt as to the balanced relationship between refraction and muscle activity. It is fundamental enough for us to hold fast to our knowledge thereof.

"There shouldn't be any doubt that of the twelve muscles a single muscle at fault will disturb the balanced function of the other eleven muscles; or that a disturbance in function of one of the several nerves will affect the coordination of the others.

"There shouldn't be any doubt that the play of hereditary factors can leave a real deficiency in one of the many constituents, just as Daltonism is one of the deficient products thereof, affecting coordination.

"There shouldn't be any doubt that cerebral pathology leaves permanent destruction in one or more of the constituents, affecting coordination.

"There shouldn't be any doubt that the disturbance of psychic factors will affect the coordination of the others.

"That any man or any science is so bold as to claim a restoration of 100 per cent of the cases of ocular muscle imbalances is absurd, so far as I am concerned.

"Fortunately, however, the great bulk of such cases are amenable to optometric aid, for they do have their origin, for the most part, in errors of refraction.

"But, time, optometric skill and good judgment are the essentials that will have to be employed to gain maximum beneficial results.

"I know of no formula, and I doubt if one can be found, that will determine the length of time required to eradicate erroneous association paths and at the same time restore correct association paths; or to determine how long it will take to stimulate blunted brain cells to normal function; or to determine how long it will take to revive psychic function. In respect to time, every patient will be a law unto himself, unless it favor youth as against age.

"Optometric skill is an important factor. If any law can be announced, it will be that the fewer adaptations necessary, the more certain and speedy will be the accomplishment of binocular restoration. Good refraction is being done by many Optometrists, but the percentage is still far from high.

"Optometric judgment is a very important factor. In another article, I tried to point out that optometrists try to do too much at one sitting. A refraction is done and the patient is assured that he can go on for several years. He is a miracle worker, indeed, who can write a formula that cannot be improved on in several weeks. Of course, habit formations are things of inconsequence! They fit the refraction; the refraction is not made to fit the habit!

"Less theorizing, please, in respect to ocular muscles, and more application of fundamental optometric science."

* * * * * *

BETTER VISION INSTITUTE

Optometrists, Wholesale Material Supply Men, Manufacturers of Optical Material and Dispensing Opticians have joined forces in an effort to improve business and professional conditions in the various branches of the optical industry.

Mr. Ernest H. Gaunt is secretary of this new organization which is called the Better Vision Institute and through his hands are expected to pass many plans which when carried out should prove beneficial to the various elements of this industry.

On the board of directors of this new organization are to be found Drs. Hamilton, Hill, Hotaling and Hughes who will represent the optometric viewpoint in the direction of the activities of this organization. Optometrists are urged to join this organization and to support it. The annual dues are $5.00 and from some of the advance material which the editor of this Journal has been shown, he believes that every practitioner will be amply repaid for the interest shown by joining.

The other officers of the Better Vision Institute are as follows: Mr. E. D. Nerney, President; Mr. J. W. Collinson and Mr. M. H. Eisenhart, Vice-Presidents, and Mr. Ira Mosher, Treasurer.

* * * * * *

PHYSICAL THERAPY LECTURES

Dr. J. I. Kurtz, optometrist of Minneapolis, Minnesota, chairman of the committee of Physical Therapy of the American Academy of Optometry recently returned from the East where a series of lectures and clinical demonstrations of Ocular Physical Therapy were given, in a number of cities.

According to Dr. Howard T. Lewis, Secretary of the Optometric Research Society of Western Pennsylvania, Dr. Kurtz demonstrated clearly the value to Optometry of the use of Electro Therapy in the treatment of Pseudo-Myopia, Amblyopia, and cases of muscular imbalance.

Dr. Kurtz reports the lectures in general were very well attended with a surprising amount of interest shown in this new phase of our work. It is highly probable that during 1930 another series of lectures will be given on this subject by Dr. Kurtz.

* * * * * *

MEETING IN ST. LOUIS

The Optometric Study Club of St. Louis held the first meeting of the year at the office of Dr. Frank A. Ilg on January 10th. This group has been meeting regularly under the direction of the Graduate Clinic Foundation, the entire evening being taken up with discussion of various case reports.

* * * * * *

AMERICAN OPTOMETRIC ASSOCIATION

Dr. George S. Holton, President of the American Optometric Association, proclaims the week of February 16th as "Save Your Vision" week and urges all optometric societies to make suitable observation of this event.

* * * * * *

MINNESOTA OPTOMETRIC ASSOCIATION

The annual sessions of the Minnesota State Association of Optometrists will be held at the St. Francis Hotel, St. Paul, Minnesota, February 17th to 21st. Dr. A. M. Skeffington of the Graduate Clinic Foundation will conduct a series of clinics during this period at which every member is expected to be present. The sessions will open Sunday morning at 10:30 and it is hoped that the delegates will be in their places promptly as much of the routine business of the society is to be transacted on the first day.

* * * * * *

AN OMISSION

Dr. J. W. Pascal in a letter from Austria informs us that the last two paragraphs of his paper dealing with "Optometry in England" were somehow lost from the text when it was published and requests that in fairness to the good men of England that these paragraphs be published. The pargraphs are as follows:

"The leading papers of England are the 'London Optician & Scientific Instrument Maker,' whose associate editor, Mr. W. E. Hardy, I had the pleasure of meeting on several occasions; 'The Dioptric Bulletin' and 'British Journal of Physiological Optics,' published by the British Optical Association. 'The Refractionist' is the official organ of the Institute of Ophthalmic Opticians and its editor, Mr. J. Harcombe Cuff, besides being editor of this magazine and active in all affairs relating to the Institute and hospital, is a most genial and chaming host, and we had the pleasure of enjoying his hospitality on many occasions.

"Before closing I must say a word about the hospitality shown towards American optometrists. Englishmen have long held the reputation of being cold and unresponsive. I was therefore most pleased to find amongst the refractionists at least a far different state of affairs. I had not personally known anyone outside of Mr. Lionel Laurance, whom I had met several times socially and otherwise. But it took very little time to realize how cordial optometrists in England are to their brothers from overseas. I cannot help but mention the chief officials of the Institute of Ophthalmic Opticians and of other organizations who made our stay in England very much pleasanter than it otherwise would have been. Among the special events, which Mrs. Pascal and myself had the pleasure of enjoying with our English friends was a small private dinner given by the officials of the Institute of Ophthalmic Opticians to Dr. J. McHoul,

an ophthalmic surgeon of note, who delivered the annual Ettles Memorial Lecture."

* * * * * *

MAINE ASSOCIATION CONVENTION

The annual meeting of the Maine Association of Optometrists was held at the Eastland Hotel, Portland, Maine, on January 8th and 9th. Dr. Edwin Forbes Tait of the Pennsylvania State College of Optometry was the chief speaker, his subject being "Dynamic Skiametry," and the following men were elected to serve for the coming year: Dr. Walter F. Conley, President; Dr. Paul J. Carey, First Vice-President; Dr. Philip E. Lessard, Second Vice-President; Dr. Arthur L. Corriveau, Secretary and Treasurer; Dr. Delbert E. Flaisted, Dr. William L. Leavitt, Dr. Howard L. Bryant, Dr. Gleason A. Rand, Dr. Ernest L. Greenleaf, Directors.

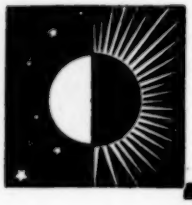
* * * * * *

BACK COPIES OF JOURNAL WANTED

The Pennsylvania State College of Optometry wishes to complete its files of the American Journal of Optometry and is lacking the following copies: Volume II, Nos. 3, 4; Volume III, Nos. 3, 6, 7, 9, 12; Volume IV, Nos. 2, 4, 6, 8, 10, 11, and Volume V, No. 12.

Any of our readers who may be able to spare any of the above mentioned copies are urged to mail them either to the offices of the American Journal of Optometry or direct to the Pennsylvania State College of Optometry, 1809 Spring Garden Street, Philadelphia, Pa., in care of Dr. Edwin F. Tait, Registrar.

* * * * * *



JOIN

The BETTER

With such a group of
the institution will surely grow

★

OFFICERS

PRESIDENT

Edwin D. Nerney.....Bay State Optical Company

VICE-PRESIDENTS

John W. Collinson.....Shur-on Standard Optical Company

M. Herbert Eisenhart.....Bausch & Lomb Optical Company

TREASURER

Ira Mosher .....American Optical Company

SECRETARY

Ernest H. Gaunt.....220 Fifth Avenue, New York

We urge you

Bausch & Lomb Optical